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ABSTRACT

This document summarizes the status of environmental engineering programs in the United States and Canada today. The volume contains information on over 70 university programs. Each listing gives a two- or three-paragraph description of the program, institution, etc. In addition, information can be found on admission requirements, degree requirements, course work, faculty, students, and facilities. (Author/BB)

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register of environmental engineering graduate programs

Edited By
Jane C. Klosky

Sponsored by
Association of Environmental Engineering Professors
American Academy for Environmental Engineers

Funded by
US Environmental Protection Agency

SE 024 010

Third Edition, July 1974

Preface

This third edition of THE REGISTER summarizes in considerable detail the status of environmental engineering programs in the United States and Canada today. The volume will assist the administrator, counselor, and student in finding detailed information concerning the variety of environmental engineering programs available and in selecting the one that will best prepare the student for his career in environmental engineering. Further information concerning a program should be obtained by corresponding with the program director listed for the particular institution. A guide to the format used in THE REGISTER is found on page v.

Additional copies of THE REGISTER may be obtained free of charge by contacting:

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Austin, TX 78712

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*Bernard B. Berger (Member, AEEP Register Committee, 1972-74), Director, Water Resources Research Center, University of Massachusetts

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*Linvil G. Rich (Board Contact, AEEP Register Committee, 1972-73), Professor, Environmental Systems Engineering, Clemson University

In addition, recognition is given to Janie Kirkwood, graphic designer, who provided invaluable assistance and consultation during the preparation of THE REGISTER.

*Member of the Association of Environmental Engineering Professors (AEEP) and the American Academy of Environmental Engineers (AAEE).

Name of Institution

Location: City, State

Name of Department or Degree-granting Program
College or School within Institution

Specific Degree Program Covered

SEAL OF UNIVERSITY (OPTIONAL)

ECPD Accredited--Specific Program or Department

Name, title, address,
and telephone number of
individual(s) who should
be contacted for additional
information

Date information submitted (or an updated version received)

Two or three very concise paragraphs describing the program(s), the institution, etc. including the following:

(a) Orientation or emphasis of the program(s) and possible options therein, specific objectives of the program(s), degrees offered, etc.

(b) Nature of the institution, enrollment (graduate and undergraduate), noteworthy cooperating or supporting areas, disciplines, or facilities at the institution outside the program(s) covered, tuition and other fees applicable to graduate students in the program(s), etc.

(c) Any other information about the community, etc. that might be useful for prospective students.

Admission Requirements

(a) Minimum undergraduate or other grade point average based on a 4.0.

(b) Minimum scores on Graduate Record Examination or other examination. If GRE is used, whether combined score is the criterion or a minimum on each of the verbal and quantitative portions. Also, whether advanced GRE test is required.

(c) If provisional or conditional admission is possible and, if so, under what circumstances.

(d) Minimum score on language examinations for foreign students [specify which test, e.g. Test of English as a Foreign Language (TOEFL), etc.].

(e) Undergraduate disciplines normally acceptable for admission to the program(s).

(f) Make-up courses or prerequisites required of nonengineers entering the program(s).

(g) Any other admission requirements.

(h) Doctoral admission requirements that are different from those of the Master's program.

Degree Requirements

Degree	Credits*	Thesis	Language	Residence*	Time (mo.)
Specific degree(s) offered	Minimum number normally required	Yes, no, optional, or if technical report is required instead	If required, how many or if substitution is permissible	Length of residence required at the University	Number of months normally required for completion of degree

*S = semesters or semester hours
Q = quarters or quarter hours

[a]Other information that is pertinent to requirements for the degree.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
Course number or code used by university	Specific course title	Name of person(s) teaching course	Number of credits for course (S or Q)	When course was last presented F=fall S=spring Su=summer A=autumn W=winter	Enrollment in course at present or when it was last presented

Information is supplied for courses available within the department or program as well as supporting courses outside department or program that specifically relate to or complement the program.

Courses outside the department are separated from those within the department by a double space.

Faculty

NAME OF FACULTY MEMBER (who presents course work or directs theses in the environmental engineering area in the department or program)
Rank
Department
Date first appointed at institution

Degrees	Institution	Discipline	Year

Major teaching and research areas in the environmental area

% of effort in the environmental area (breakdown of % teaching, % research, % administration)

A maximum of five representative publications listed in descending order of importance

Maximum of three representative current or recent *sponsored* research projects (title, sponsor, dates in effect, relation to project)

Registered professional engineer: State(s) where registered

Full-time professional experience *prior* to present appointment. Total years (breakdown by areas: academic, consulting, research, government, industry)

Member of Association of Environmental Engineering Professors (AEEP)
Diplomate of American Academy of Environmental Engineers (AAEE)
Professional activity (maximum of five) including professional societies (present or past officer, director, committee chairman, committee member, or similar position), funding or research agency (consultant, member of site visit team, etc.), or similar professional activities

---

NAME OF FACULTY MEMBER (outside department or program who is actively involved in environmental area and who contributes directly to the teaching and research efforts of the program)
Rank
Department
College or School (if different from degree-granting program)

Highest degree earned	Institution	Discipline	Year

Total % in environmental area
Member of Association of Environmental Engineering Professors (AEEP)
Diplomate of American Academy of Environmental Engineers (AAEE)

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Degree Program	Master's	0	0	0	0	0	0	0	0	0	0	ENROLLMENT *(for past 5 yrs.)* *FT = full-time* *PT = part-time*
	Doctoral	0	0	0	0	0	0	0	0	0	0	
Degree Program	Master's	0		0		0		0		0		GRADUATES
	Doctoral	0		0		0		0		0		
Degree Program	Master's	0		NON-US NATIONALS				*(presently enrolled in degree program)*				
	Doctoral	0										

	Master's	Doctoral	
EPA traineeship	0	0	SUPPORT *(of currently enrolled students)*
Other traineeship	0	0	
EPA doctoral fellowship	0	0	
Research assistantship	0	0	
Teaching assistantship	0	0	
Other university support	0	0	
Industrial fellowship	0	0	
Foundation support	0	0	
Government employer	0	0	
Industrial employer	0	0	
Consultant employer	0	0	
Self-supported	0	0	
Consulting	0	0	EMPLOYMENT (%) *(for past 5 yrs.)*
R & D	0	0	
Industry	0	0	
Federal government	0	0	
Other government	0	0	
Academic	0	0	
Further study	0	0	
Outside environmental area	0	0	
Military	0	0	
Unknown	0	0	

Facilities

A very brief, concise statement of facilities available within and to the program(s) being described. Emphasis is upon special facilities not normally or routinely available in typical programs. This section is optional.

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Akron State University

Akron, Ohio

Civil Engineering Department
College of Engineering

Civil Engineering

ECPD Accredited--Civil Engineering

Dr. George P. Manos, Associate Professor
Civil Engineering Department
302 East Buchtel Avenue
Akron State University
Akron, OH 44325
(216) 375-7287

May 1973

The orientation of the environmental engineering graduate program is one of the options in the civil engineering curriculum. The student can specialize to some extent in the areas of environmental engineering, water resources, hydraulics, and wastewater management. We offer the following degrees in the Civil Engineering Department: MSEngr (environmental engineering option), MSCE (environmental engineering option), and PhD.

The University formerly was a municipal university and became state supported in 1968. The enrollment is approximately 19,000 with about 1800 graduate students. Associated with the University is the Institute of Polymer Science and Rubber Technology. The Institute has been involved with research activity in synthetic rubbers and plastics and our faculty and students are engaged in cooperative research with the Institute.

Tuition and fees for full-time graduate students average $2500 for an academic year. The University annually awards a number of graduate assistantships to qualified students. These assistantships provide a stipend of $2400 to $3600 plus remission of tuition and fees and are available in all departments with graduate programs.

Akron State University is located 30 miles south of Cleveland, and the City of Akron is considered as the rubber capital of the world. The community is an urban area of approximately 500,000 and is the home of the four largest rubber companies in the United States.

Admission Requirements

(a) 3.0/4 for MSEngr, MSCE and PhD.

(b) GRE is not required by Dean of Graduate School and is optional at college or department level.

(c) Special admission may be given to those persons who do not qualify for full admission for GPR down to 2.3/4 provided strong recommendations are submitted. Student must obtain 3.0/4 overall after 18 quarter credit hours to obtain full graduate standing.

(d) Foreign students must score at least 550 on the TOEFL.

(e) Any engineering discipline at an accredited institution is acceptable. Individuals with undergraduate degrees in chemistry and biology are also normally acceptable, as well as persons with backgrounds in public administration.

(f) For nonengineering students, up to 18 quarter credits of undergraduate courses may be required. Courses in environmental engineering, fluid mechanics, hydraulics may be taken formally or by examination.

(g) Applicants must apply for admission to the graduate school. A letter of recommendation should be submitted from former professors. For the PhD, two letters of recommendations are required from such individuals or engineering supervisors where previously employed.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	45Q	Optional	No	No	-
MSCE--Envir. Engr.	45Q	Optional	No	No	-
PhD	90Q	Yes	[a]	Yes[b]	-

[a] Two reading knowledge; one comprehensive knowledge.

[b] Three consecutive quarters.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
430:620	Sanitary Engineering Problems	Manos	3Q	F'72	4
430:621	Industrial Waste Treatment I	Manos	3Q	F'72	4
430:622	Industrial Waste Treatment II	Manos	3Q	W'72	3
430:623	Industrial Waste Treatment III	Manos	3Q	S'73	3
430:641	Advanced Hydraulics	Simon	3Q	F'72	9
430:643	Advanced Fluid Mechanics	Sarikelle	3Q	W'73	9
430:691	Special Problems I	Staff	3Q	W'73	4
430:692	Special Problems II	Staff	3Q	S'73	4
420:563	Air Pollution Control	Atwood	3Q	F'72	8
420:564	Water Pollution Control	Forsythe	3Q	W'73	8

347:571	Applied Statistics I	Sweet	3Q	W'73	15
347:572	Applied Statistics II	Suich	3Q	S'73	14
310:517	Psychology	Goldstrohm	4Q	F'72	20
310:527	Limnology	Olive	4Q	S'73	15
315:517	Instrumental Methods of Analysis	Bachman	3Q	F'72	12
315:625	Colloid Chemistry	Corsaro	2Q	W'71	31
920:665	Seminar in Land Use Planning	Moore	3Q	Su'73	25
920:697	Legal Control of the Environment	Silverman	4Q	F'73	25

430:620,621,622,623,691,692; 347:571 and 572 and 310:517 and 527 are required for all environmental engineering majors. Master's and PhD programs are flexible whereby students may take additional courses in biology and chemistry for interdisciplinary study.

Faculty

GEORGE P. MANOS
Associate Professor
Civil Engineering Department
1957

BSChE	Ohio State University	Chemical Engineering	1948
MSE	West Virginia University	Sanitary Engineering	1966
PhD	University of Cincinnati	Environmental Engineering	1971

Water and wastewater treatment, stream analysis, water renovation

100% (50% teaching, 30% research, 20% administration)

"Kinetics as Design Criteria for Post Chlorination," Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, 99, 1, 1973 (with Panos Kokoropoulos)

Registered professional engineer: Ohio

Previous full-time professional experience: 9 yrs. (7 yrs. government and 2 yrs. industry)

Diplomate AAEE
Past Chairman, Ohio Water Pollution Control Conference (1963-64)
Consultant, Summit County Sanitary Engineer (1970-date)

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	0	6	0	6	0	6	0	6	0	6	ENROLLMENT
	Doctoral	1	0	1	0	1	0	1	0	0	0	
Environmental Engineering	Master's	0		0		0		0		2		GRADUATES
	Doctoral	0		0		0		1		0		
Environmental Engineering	Master's	1		NON-US NATIONALS								
	Doctoral	0										

	Master's	Doctoral	
Teaching assistantship	0	1	SUPPORT
Research assistantship	1	0	
Government employer	8	0	
Industrial employer	2	0	
Self-supported	1	0	
Other government	100	0	EMPLOYMENT (%)
Academic	0	100	

Facilities

Akron State University has ample facilities which may support advanced research on water and wastewater treatment projects. The Civil Engineering Department has ample laboratory facilities to accommodate twenty-four student stations and facilities for four graduate students. An additional chemical engineering unit operations laboratory is available for those students in need of rate transfer kinetic studies. The Institute of Polymer Science provides additional laboratory equipment for research areas in plastic films for reverse osmosis studies. Total organic carbon analyzers, gas and liquid chromatography and Beckman spectrophotometer equipment are available from the Department of Chemistry.

University of Arizona

Tucson, Arizona

Department of Civil Engineering and Engineering Mechanics
College of Engineering

Sanitary Engineering

ECPD--Accredited--Department of Civil Engineering

Dr. Raymond A. Sierka
Department of Civil Engineering and Engineering Mechanics
University of Arizona
Tucson, Arizona 85721
(602) 884-2410

May 1973

The orientation of the graduate sanitary engineering program at the University of Arizona is toward producing engineers qualified to direct activities concerned with the production of both the quality and quantity of the nation's water supply. The program emphasizes water quality maintenance and new source development as well as reuse potentials. Engineers derived from this program should have a high level of competence to deal with problems concerned with all aspects of water supply and water quality control as well as qualifications to maintain effective lines of communication between and among the interdisciplinary array of scientists, engineers, public officials, resource managers, technicians, and laymen who may be involved in the broader aspects of research and development in water pollution control. Goal oriented coursework is supported by a formal thesis. An MS Degree as well as the PhD Degree is offered within the Department of Civil Engineering.

The University of Arizona is a typical land grant institution which is well equipped in both faculty and physical resources to undertake graduate programs leading to advanced degrees in more than 100 departments and fields. The enrollment is approximately 27,000 students with approximately 8,000 graduate students. Associated with the University of Arizona is the Steward Observatory, the Lunar and Planetary Laboratory, the Engineering Experiment Station, The Water Resources Research Center, the Institute of Atmospheric Physics, and the Office of Arid Lands Studies. Typical tuition and fees for full-time graduate students average $1,300 for an academic year. The University of Arizona is located in Tucson, Arizona, which is a community of approximately 350,000 people. Excellent all-year round weather combined with fine housing for both single and married students makes the campus an ideal spot for study.

Admission Requirements

(a) 3.0/4 for MS and 3.0/4 overall for PhD.

(b) GRE is not required, however, it may be submitted as evidence for basis of admission to the Graduate College.

(c) Provisional or conditional admission is possible with specific provisions dictated by the Graduate College and the Department after consultation over the admitted transcript.

(d) Foreign students must demonstrate their proficiency in the English language as one of the conditions for admission. The University requires foreign applicants to take TOEFL.

(e) To qualify for acceptance in the program of graduate study in sanitary engineering, the student must have a BSEngr from any accredited university. In certain cases, candidates from other than engineering disciplines, including chemistry, biology, and microbiology, might be considered if certain deficiencies are made up.

(f) During the first term make-up courses specifically in fluid mechanics and elementary sanitary engineering are required of nonengineering students.

(g) Applicants must file two letters of recommendation with application for admission papers to the University.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Sanitary Engr.	30S	Yes	No	2 Sem.	12
PhD--Sanitary Engr.	72S	Yes	1	6 Sem.	36

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 275	Microbiology of Sanitary Engineering	Phillips	-	F'72	12
CE 276	Chemistry for Sanitary Engineering	Kasper	-	F'72	12
CE 375	Advanced Wastewater Disposal Systems	Sierka	-	F'72	8
ChE 280	Unit Operations of Water & Wastes	Wendt	-	F'72	10
CE 373	Advances in Water & Waste Reclamation & Reuse	Sierka	-	S'73	8
CE 371	Advanced Water & Wastewater Analysis	Phillips	-	S'73	8
CE 376	Advanced Water Distribution & Treatment System Design	Kasper	-	S'73	8
CE 399j	Seminar--Sanitary Engineering	Sierka	-	S'73	16
Chem 280a	Physical Chemistry	Staff	-	F'72	6
Geol 235	Hydrogeology	Wright	-	F'72	8
Geol 335	Aquifer Mechanics	Simpson	-	S'73	9

Courses required of all sanitary engineering majors include: CE 275, 276, 373, 375, 376, 399j, ChE 280.

Faculty

RAYMOND A. SIERKA
Associate Professor
Department of Civil Engineering and Engineering Mechanics
1969

BS	University of Pittsburgh	Chemical Engineering	1960
ME	University of Oklahoma	Sanitary Engineering	1967
PhD	University of Oklahoma	Sanitary Engineering	1969

Advanced waste treatment processes, biological waste treatment

100% (60% teaching, 30% research, 10% administration)

"The Use of Power Plant Heat in a Physical-Chemical Domestic Wastewater Renovation System." *Proceedings*, Natural Conference on Complete Water Reuse, April 1973 (with R. A. Fazzolare)

Energy Needs and the Environment. Tucson, Arizona: The University of Arizona Press, 1973 (co-editor with R. G. Seale)

"Pyrolysis of a Liquid Citrus Waste," 73rd National Meeting, American Institute of Chemical Engineers, Minneapolis, Minnesota, August 27-30, 1972

"Activated Carbon Adsorption of Detergents from Various Wastewaters," US Army, 9/71-8/72, principal investigator

"Pyrolysis Treatment of Citrus Wastes," Anaheim Citrus Products Company, 6/72-5/73, principal investigator

"Feasibility Study of a Nuclear Power-Sewage Treatment System for the Conservation and Reclamation of Water," Water Resources Research Center of the University of Arizona, 7/72-6/73, co-principal investigator

Registered professional engineer: Pennsylvania

Previous full-time professional experience: 6 yrs. (industry)

Consultant, EPA, Water Quality Programs (1973)
Consultant, Airesearch Manufacturing Company of Arizona

ROBERT ARTHUR PHILLIPS
Professor
Department of Civil Engineering and Engineering Mechanics
1960

BS	University of Massachusetts	Public Health and Bacteria	1954
MS	Rutgers University	Sanitation	1957
PhD	Rutgers University	Sanitation	1960

Environmental microbiology, urban runoff quality, ground water quality, urban sanitation

100% (75% teaching, 25% research)

"Isolation and Preservation of Cultures of Sphaerotilus," *Applied Microbiology*, 9:291, 1961 (with N. C. Dondero and H. Heukelekian)

"Disinfection Procedures at Wallace, Idaho, Municipal Swimming Pool," Washington State University Research Publication 6 1/12-47, 1961

"New Aspects of Wastewater Reclamation," *American City*, *79*, 91, 1964 (with T. Helfgott and E. Weisberg)

"Continuous Loading of Completely Mixed, High Rate Anaerobic Digesters," *Bulletin Arizona Water and Pollution Control Association*, XXVI, 117, 1966

"Assessing Microbiological Quality of Waste Waters," *Bulletin Arizona Water and Pollution Control Association*, XXXVII, 61, 1967

"Hydrological and Environmental Controls on Water Management in Semi-Arid Urban Areas," Office of Water Resources Research, 7/71-6/73, co-investigator

"Physicochemical Transformations within Ephemeral Streambeds Related to Sewage Effluent Releases," Office of Water Resources Research, 7/72-6/74, principal investigator

Previous full-time professional experience: 4 yrs. (2 yrs. academic, 2 yrs. research and development)

Arizona Water and Pollution Control Association

DENNIS R. KASPER
Assistant Professor
Department of Civil Engineering and Engineering Mechanics

BS	Loyola University, Los Angeles	Civil Engineering	1966
MS	California Institute of Technology	Civil Engineering	1967
PhD	California Institute of Technology	Environmental Engineering Science	1971

Environmental chemistry, solid-liquid separations, water treatment processes

100% (65% teaching, 35% research)

Member, American Water Works Association
Member, American Society of Civil Engineers
Member, Water Pollution Control Federation

J. O. WENDT
Assistant Professor
Chemical Engineering Department

PhD	Johns Hopkins University	Chemical Engineering	1968

Transport phenomena for sanitary engineers
30%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Sanitary Engineering	Master's	4	0	3	3	6	0	10	3	12	3	ENROLLMENT
	Doctoral	1	1	2	0	2	0	2	0	4	0	

		68-69	69-70	70-71	71-72	72-73	
Sanitary Engineering	Master's	3	2	6	2	6	GRADUATES
	Doctoral	0	0	0	3	0	

	Master's	Doctoral	
EPA traineeship	6	0	SUPPORT
Research assistantship	2	0	
Teaching assistantship	1	1	
Industrial fellowship	0	1	
Government employer	0	1	
Industrial employer	0	1	

	Master's	Doctoral	
Consulting	42	66	EMPLOYMENT (%)
Industry	5	0	
Federal government	26	33	
Other government	10	0	
Military	5	0	
Outside environmental area	5	0	
Unknown	5	0	

Facilities

Space allocated solely for sanitary engineering includes a 1000 sq ft chemistry teaching laboratory, 900 sq ft graduate research laboratory, separate glass washing and storage room and chemical storage and balance room. Three constant temperature walk-in rooms are supplemented with smaller refrigerators, incubators, and water baths. Major items of equipment located in these laboratories and available for instruction and research include light and phase microscopes, photomicrographic equipment, stereomicroscopes, colony counters, refrigerated Warburg apparatus, centrifuges, gas chromatograph, thermal conductivity and flame ionization detectors, spectrophotometers, dissolved oxygen meter, pH meters, flame photometer, fluorometers, Kjeldhal-nitrogen distillation and digestion units (macro- and micro-), single- and multi-channel recorders, platform shaker, drying ovens and muffle furnace, vacuum and water pumps, Beckman total organic carbon unit, COD apparatus, desk calculators, and equipment for air pollution surveillance. An electron microscope and an x-ray diffractometer are also available in the department. Arrangements with other units within the University have been excellent for the use of additional items of equipment as needed.

University of Arkansas

Fayetteville, Arkansas

Department of Civil Engineering
College of Engineering

Environmental Engineering
Civil Engineering

ECPD Accredited--Undergraduate Civil Engineering

Dr. Hugh M. Jeffus
Coordinator of Environmental Studies
340 Engineering Building
University of Arkansas
Fayetteville, AR 72701
(501) 575-4955

February 1974

The focus of our program of graduate study in environmental engineering is to provide a quality program terminating with the Master's Degree. The primary objective of our program is to develop a graduate with professional competency in government service, industrial employment or consulting engineering practice. Present emphasis of the program is primarily directed toward water resources and wastewater pollution. Recognition is given to air pollution, radiological health hazards, and solid waste management. The program is confined to graduate study and research activities for those students able to continue in an environmental engineering program of study following a BS Degree. Program content is flexible enough to allow emphasis on either planning or design of water supply and pollution control projects. The degrees offered in the program are PhD, MSCE (Sanitary Option) for those students who have a BSCE Degree, and an MSEnE offered to those students who have an engineering degree other than civil engineering or who have a strong science degree.

The University of Arkansas at Fayetteville is a land grant institution with an enrollment at the Fayetteville campus of approximately 12,000 students. There is also a University of Arkansas at Little Rock, at Monticello, at Pine Bluff and a Graduate Institute of Technology at Little Rock. The University of Arkansas at Fayetteville is the only institution in the state that has an accredited engineering program. The graduate enrollment of the Fayetteville campus is in excess of 1600. Tuition and fees for a full-time graduate student are $400 for an academic year or $20 per semester hour, whichever is less. Nonresident tuition is $930 per academic year or $46.50 per semester hour, whichever is less.

The University is within the city limits of Fayetteville which is a community of approximately 30,000 people. The city of Fayetteville is located in the Ozark Mountains with excellent recreational facilities.

Admission Requirements

(a) 2.5/4 for Master's program or 3.0/4 for a PhD.

(b) A combined score of 1050 on the verbal and quantitative parts of the GRE tests is required.

(c) Conditional admission is possible after interview and examination of previous transcripts. Student must obtain a 3.0/4 in the first semester to obtain full graduate standing.

(d) A minimum score of 850 on the Standard English Comprehension Examination must be achieved for a foreign student to gain admission.

(e) Undergraduate degree in civil engineering from any accredited institution is acceptable for the MSCE (Sanitary Option). Any undergraduate engineering degree from an accredited institution is acceptable for the MSEnE Degree. Individuals with an undergraduate degree in chemistry, biology, and math are also normally accepted in the MSEnE program.

(f) Nonengineers entering the MSEnE program must complete the courses that are normally subject matter on the Engineer In Training examination. All candidates are expected to complete the Engineer In Training examination before leaving school.

(g) Other degree requirements are successful completion of a comprehensive examination covering all coursework plus an oral exam in defense of either a thesis or a special report.

(h) Normally, admission to the doctoral program requires a Master's Degree.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MSCE (Sanitary Option)	30	[a]	No	1 yr.	12
MSEnE	30	[a]	No	1 yr.	12
PhD	Varies	Yes	1	2 yr.	36

[a] A thesis, six hours credit, or a special report, three hours credit, must be completed for the MS Degree.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 3203	Environmental Engineering	Staff		S'73	23
CE 4143	Soils Engineering I	Welch		F'72	28
CE 4243	Water & Wastewater Process Design	Jeffus & Moore		S'73	20
CE 5203	Chemistry for Sanitary Engineers	Moore		F'72	9
CE 5233	Lab. Analysis of Water & Wastes I	Mitchell & Moore		F'72	10
CE 5253	Sanitary Microbiology	Mitchell		S'73	10
CE 5273	Indus. Water Supply & Wastes Treat.	Moore		Su'72	17
CE 5283	Water Supply & Wastewater Disposal	Parker & Jeffus		S'73	11
CE 5403	Adv. Reinforced Concrete II	Baumgartner		S'73	16
CE 5733	Sanitary Engr. Process Control	Mitchell		S'73	6
CE 4273	Water Resource Planning & Design	Jeffus		F'72	14
CE 4283	Solid Waste Management	Moore		S'73	13
CE 5743	Aquatic Biology for Engineers	Mitchell		Su'72	12
CE 5753	Air Pollution	Moore		F'72	11

CE 4253	Water Resources Planning	Moore	S'73	14
CE 4263	Environmental Engineering II	Parker	F'72	-
CE 4533	Public-Works Administration	Jeffus	Su'72	24
CE 563V	Special Problems	Staff	S'73	3
CE 5723	Radiological Health Engineering	Jeffus & LeFevre	S'72	16
CE 600V	Master's Thesis	Staff	S'73	2
BACT 2014	General Bacteriology	Micro Dept.	-	-
ES 4423	Numerical Methods I	Crook	-	-
ChE 4253	Rate Proc. in Environment	Thibodeaux	-	-

CE 4143 and CE 5403 are not required for the MSEnE Degree.

Faculty

HUGH M. JEFFUS
Associate Professor and Coordinator of Environmental Studies
Civil Engineering Department
1963

BS	University of Arkansas	Civil Engineering	1962
MS	University of Arkansas	Civil Engineering	1963
Doctor of Engr.	University of Oklahoma	Civil Engineering	1969

Hydrology, water and waste treatment, environmental health

100% (50% teaching, 25% research, 25% administration)

"Quantitative Analysis of Stream Flow-Rate Extremes," Arkansas Water Resources Research Center Publication No. 1, 1967

"Hydrologic Studies in Arkansas," Arkansas Professional Engineer, July 1967

"Water Quality Studies of Arkansas Streams," University of Arkansas Engineering Experiment Station Research Report Series No. 11, October 1967 (with J. A. Proctor and L. R. Heiple)

"An Application and Evaluation of Operations Research to Water Supply Reservoir Design," Doctoral Dissertation, The University of Oklahoma, 1969

"Water Resources Planning Study for Arkansas and Oklahoma," Water Resources Research Center Publication No. 7, 1970 (with L. R. Heiple)

"An Investigation of the Factors Affecting Foam Fractionation of Soluble Organics in Wastewater"

"Quantitative Analysis of Stream Flow-Rate Extremes"

"Water Quality Studies of Arkansas Streams"

Registered professional engineer: Arkansas and Missouri

Previous full-time professional experience: 3 yrs. (government)

Member, American Society of Engineering Education
Member, American Society of Civil Engineering
Member, Water Pollution Control Federation
Member, Arkansas Water Pollution Control Association (past Secretary-Treasurer)
Member, Arkansas Society of Professional Engineers (Secretary-Treasurer 1967)

JAMES W. MOORE
Assistant Professor of Civil Engineering
Department of Civil Engineering

PhD	University of Kansas	Environmental Health Engineering	1972

Solid waste management, sanitary chemistry, sludge treatment disposal, air pollution
100%

DEE T. MITCHELL
Assistant Professor of Civil Engineering
Department of Civil Engineering

Doctor of Science	Washington University		1969

Eutrophication studies, aquatic biology, laboratory analysis of water and wastewater, sanitary engineering and process control, sanitary microbiology
100%

DAVID G. PARKER
Assistant Professor of Civil Engineering
Department of Civil Engineering

PhD	Virginia Polytechnic Institute	Civil Engineering	1971

Advanced waste treatment, environmental health, water quality studies of surface streams
100%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Civil Engineering (Sanitary Option)	Master's	7	1	13	1	10	0	7	0	6	0	ENROLLMENT
	Doctoral	1	0	1	0	0	0	0	0	0	0	
Environmental Engineering	Master's	-		-		9	0	10	0	6	0	
	Doctoral	-		-		0	0	0	0	1	0	

		69-70	70-71	71-72	72-73	73-74	
Civil Engineering (Sanitary Option)	Master's	8	8	10	4	8	GRADUATES
	Doctoral	0	0	0	0	0	
Environmental Engineering	Master's	-	-	-	6	5	
	Doctoral	-	-	-	0	0	

Civil Engineering (Sanitary Option)	Master's	1	NON-US NATIONALS
	Doctoral	0	
Environmental Engineering	Master's	0	
	Doctoral	0	

	Civil Engr. (San. Option)		Environmental Engineering		
	Master's	Doctoral	Master's	Doctoral	
EPA traineeship	4	0	1	0	SUPPORT
Research assistantship	1	0	4	0	
Teaching assistantship	0	0	1	0	
Government employer	0	0	1	0	
Industrial employer	1	0	0	0	
Consultant employer	1	0	3	0	
Consulting	27	0	62.5	0	EMPLOYMENT (%)
Research and development	2.7	0	0	0	
Industry	29.7	0	0	0	
Federal government	19	0	0	0	
Other government	10.8	0	25	0	
Academic	0	0	12.5	0	
Further study	5.4	0	0	0	
Military	5.4	0	0	0	

Auburn University

Auburn, Alabama

Civil Engineering Department
School of Engineering

Environmental Engineering

ECPD Accredited--Civil Engineering

Dr. J. F. Judkins, Jr.
Gottlieb Associate Professor
Civil Engineering Department
Auburn University
Auburn, AL 36830
(205) 826-4819

March 1974

The orientation of the graduate program is toward a combined offering of environmental engineering and water resources studies. The program is designed to produce engineers capable of applying fundamental principles of the sciences to analyze and solve problems which relate to man's environment.

The degree program in environmental engineering consists of core courses in environmental chemistry, microbiology, water and waste treatment theory, stream sanitation, and industrial waste treatment. The degree program in water resources includes core courses in hydrology, engineering geology, water resources engineering, seepage, open channel flow, and water resources systems.

Auburn University is a fully accredited institution of higher education with its administrative organization patterned into the Divisions of Instruction, Extension, and Research. The enrollment is approximately 15,000 of which approximately 1500 are graduate students. Tuition and fees for full-time graduate students average approximately $700 for an academic year.

Auburn University is located in Auburn, Alabama and was established in 1856. The city is situated 60 miles northeast of Montgomery, 120 miles southeast of Birmingham, and 125 miles southwest of Atlanta, Georgia. The city has an area of about 23 square miles and a population of approximately 23,000. The climate is characterized by warm summers and mild winters with approximately 52 inches of rainfall per year.

Admission Requirements

(a) 3.0/4 for MS.

(b) A GRE score of 1000 combined for MS; advanced examination is not required.

(c) Minimum GPA or GRE requirements may be waived in certain circumstances.

(d) Foreign students must score a minimum of 500 on the TOEFL examination to be eligible for admission.

(e) Graduates of any engineering discipline at an accredited institution are acceptable as are graduates in chemistry and biology.

(f) Engineering graduates with a non-civil engineering background may be required to take, for no credit, the undergraduate environmental engineering courses included in the civil engineering curriculum. Nonengineering graduates will be required to take math through differential equations and fluid mechanics in addition to the undergraduate environmental engineering courses.

(g) Applicants must have three letters of recommendation with at least two being submitted from former professors.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MSCE--Envir. Engr.	45Q[a]	Yes	No	4Q	12
MSCE--Water Resources	45Q[a]	Yes	No	4Q	-

[a] Includes 5 hours thesis credit.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 420	Sanitary Engineering Lab.	Judkins Morgan Jenkins	5Q	F'73	16
CE 620	Unit Operations in Water & Waste Treatment	Judkins Morgan	4Q	F'73	15
CE 621	Unit Processes in Water & Waste Treatment	Judkins Morgan Jenkins	5Q	W'74	14
CE 622	Biological & Adv. Waste Treatment	Judkins	5Q	S'74	13
CE 623	Industrial Waste Treatment	Judkins Morgan Jenkins	5Q	Su'73	5
CE 628	Stream Sanitation	Morgan	3Q	Su'73	5
CE 690	Water Chemistry	Jenkins	3Q	S'74	6
CE 411	Open Channel Flow	Miller	5Q	W'74	12
CE 421	Water Resources Engineering	Morgan	5Q	W'74	14
CE 424	Introduction to Air Pollution	Morgan	3Q	S'74	29
CE 426	Air Pollution Control	Morgan	3Q	W'74	5
CE 409	Environmental Health Engineering	Staff	5Q	S'74	23

CE 412	Hydrology	Molz	5Q	S'74	20
CE 428	Radiological Health Engineering	Morgan	3Q	F'72	13
CE 492	Linear Optimization Methods	Staff	5Q	-	-
CE 493	Discrete Optimization Methods	Staff	5Q	-	-
BY 300	General Microbiology I	Wilt	5Q	W'74	60
BY 441	Sanitary Microbiology	Wilt	5Q	W'74	18
BY 601	Biological Statistics	Staff	5Q	W'74	30
FAA 415	Limnology	Staff	5Q	S'74	20
BY 411	Phycology	Shands	5Q	S'74	18
FAA 416	Biological Productivity & Water Qual.	Boyd	5Q	F'73	16

CE 420, 620, 621, 622, 623, and 628 are required by all environmental engineering students.

Faculty

JOSEPH F. JUDKINS, JR.
Gottlieb Associate Professor
Civil Engineering Department
1967

BS	Virginia Polytechnic Inst. & State Univ.	Civil Engineering	1960
MS	Virginia Polytechnic Inst. & State Univ.	Sanitary Engineering	1963
PhD	Virginia Polytechnic Inst. & State Univ.	Civil Engineering	1967

Domestic water and wastewater treatment, industrial wastewater treatment, water chemistry

100% (66% teaching, 34% research)

"Optimization of Acid Waste Sludge Characteristics," Journal Water Pollution Control Federation, 41, 9, 1625, 1969

"Crystal Seed Conditioning of Lime-Softening Sludge," Journal of American Water Works Association, 64, 5, 306, 1972 (with R. Wynne)

"Filterability of Water Treatment Plant Sludge," Journal of American Water Works Association, 65, 6, 414, 1973 (with R. Glenn and J. Morgan)

"Color Removal from Textile Dye Waste by Coagulation," Office of Water Resources Research, 7/68-6/71, principal investigator

"Treatment of Water Plant Sludges," Office of Water Resources Research, 7/70-6/73, principal investigator

"Treatability of Textile-Domestic Waste Mixtures," Office of Water Resources Research, 7/72-6/74,

Registered professional engineer: Alabama

Previous full-time professional experience: 3 yrs. (military)

Member, Water Pollution Control Federation
Member, American Water Works Association
Member, American Society of Civil Engineers
Consultant, Harry Hendon and Associates, Birmingham, AL (1973-date)
Consultant, US Army Corps of Engineers (1972)

JOE MILLER MORGAN
Assistant Professor
Civil Engineering Department
1971

BS	Tennessee Technological University	Civil Engineering	1966
MS	Virginia Polytechnic Inst. & State Univ.	Sanitary Engineering	1968
PhD	Virginia Polytechnic Inst. & State Univ.	Civil Engineering	1972

Domestic water and wastewater treatment, industrial waste treatment, water quality modeling, air pollution

100% (66% teaching, 34% research)

"Effects of Reservoir Operating Policy on Recreational Benefits," Journal Water Resources Association, 7, 4, 765, 1971 (with P. H. King)

"The Sensitivity of Optimal Water Resource System Operating Policy to Selected Assumptions Regarding Recreation," Journal Water Resources Association, in press (with P. H. King)

"Filterability of Water Treatment Plant Sludge," Journal of American Water Works Association, 65, 6, 414, 1973 (with R. Glenn and J. Judkins)

"Application of Water Quality Prediction Models to Alabama Streams," Alabama Development Office, 1/73-6/73, principal investigator

"The Effects of Water Treatment Plant Wastes on Domestic Wastewater Treatment," Office of Water Resources Research, 7/73-6/76, principal investigator

"Allowable Loading Analyses for Selected Stream Segments in Alabama," Alabama Water Improvement Commission, 7/73-4/75, principal investigator

Registered professional engineer: Virginia

Member, AEEP
Member, American Society of Civil Engineers
Member, Water Pollution Control Federation
Member, American Water Resources Association
Member, American Water Works Association
Member, Air Pollution Control Association

FRED J. MOLZ
Assistant Professor
Civil Engineering Department
1970

BS	Drexel University	Physics	1966
MS	Drexel University	Civil Engineering	1968
PhD	Stanford University	Hydrology	1970

Subsurface hydrology, plant-moisture relationships, numerical methods

100% (66% teaching, 34% research)

"Radial Diffusion of Free Energy in Stem Phloem: An Experimental Study," Agronomy Journal (with B. Klepper)

"A Correspondence Course on Numerical Methods in Hydrology," US Department of the Interior Geological Survey (with I. Remson and G. Hornberger)

"Rehydration Versus Growth-Induced Water Uptake in Plant Tissues," Plant Physiology (with B. Klepper and C. Peterson)

"Steady State, One-Dimensional Fluid Flow through Tubes with Porous or Perforated Walls," Engineering Experiment Station, 9/70-9/71, principal investigator

"Physical and Simulation Models of the Subsurface Hydrologic System," Office of Water Resources Research, 7/71-6/74, principal investigator

"Water Pollution Control through Transpiration Drying of Sanitary Landfills," Office of Water Resources Research, 7/72-6/75, principal investigator

Registered professional engineer: Alabama

Previous full-time professional experience: 1/2 yr. (government)

Member, American Geophysical Union
Member, American Society of Civil Engineers
Member, American Society of Agronomy
Member, Soil Science Society of America
Consultant, US Army Corps of Engineers (1972)

STEPHEN R. JENKINS
Assistant Professor
Civil Engineering Department
1974

BCE	Georgia Institute of Technology	Civil Engineering	1965
MS	Harvard University	Environmental Engineering	1965
PhD	Harvard University	Environmental Engineering	1970

Water chemistry, water quality, environmental microbiology, environmental unit operations

100% (66% teaching, 34% research)

"Specific Chemical Interaction Affecting the Stability of Dispersed Systems," Croatica Chemica Acta, 42, 1970 (with W. Stumm and C. Huang)

"Effect of Selected Cation Concentration on Coagulation and Adhesion to Silica Surfaces of δ - MnO_2," Environmental Science and Technology, 7, 43, 1973

"The Effectiveness of Model Sand Filters for the Removal of Colloidal Manganese Oxides from Water Using Selected Cations as Filter Aids," Chemistry of Water Supply, Treatment and Distribution, American Chemical Society Advances in Chemistry Series, Ann Arbor Science Publishers, Inc., March 1973

"The Effectiveness of Sand Filters for the Removal of Colloidal Manganese Oxides from Water," Office of Water Resources Research, 7/73-6/74, principal investigator

"Analysis of Suitability of Evapotranspiration Waste Disposal Systems for Selected Semiprimitive Mountain Environments," US Forest Service, 6/73-1/74, principal investigator

"Survey of Existing Water Quality Information of the North Platte River," Office of Water Resources Research, 7/73-6/74, principal investigator

Registered professional engineer: Wyoming and Alabama

Previous full-time professional experience: 4 yrs. (academic)

Member, American Water Works Association
Member, American Chemical Society
Member, American Society for Engineering Education
Member, Water Pollution Control Federation
Consultant, Environmental Engineers of Wyoming, Laramie, Wyoming (1970-74)

A. WOODRUFF MILLER
Assistant Professor
Civil Engineering Department
1974

Associate	Ricks College	Math/Physics	1966
BES	Brigham Young University	Civil Engineering	1969
MS	Stanford University	Civil Engineering	1970
Engineer	Stanford University	Civil Engineering	1972
PhD	Stanford University	Civil Engineering	Exp. 1974

Hydraulics, environmental fluid mechanics, water resources

100% (66% teaching, 34% research)

"Thermal Transfer in Yellowstone Park," Publication No. 160, Stanford University, 1970

Member, American Society of Civil Engineers

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Envir. Engr.	Master's	4	0	4	0	2	0	6	0	12	0	ENROLLMENT
Water Resources	Master's	-	-	1	0	2	0	2	0	1	0	
Envir. Engr.	Master's	4		4		2		3		-		GRADUATES
Water Resources	Master's	-		-		1		1		-		
Envir. Engr.	Master's	0										NON-US NATIONALS
Water Resources	Master's	0										

	Envir. Engr. Master's	Water Resources Master's	
Research assistantship	12	-	SUPPORT
Teaching assistantship	6	-	
Other University support	1	-	
Industrial fellowship	2	-	
Foundation support	1	-	
Government employer	3	-	
Self-supported	2	-	
Consulting	66.6	100	EMPLOYMENT (%)
Industry	6.7	-	
Further study	20.0	-	
Military	6.7	-	

Facilities

Facilities consist of approximately 2200 square feet of space in the environmental engineering laboratories and an additional 2500 square feet in the hydraulics laboratory. These laboratories are equipped for instruction and research in all phases of water chemistry, unit operations, unit processes, and microbiology. The environmental engineering laboratory contains all of the modern equipment required to conduct meaningful research.

Additional facilities available on campus include the Ralph B. Draughon Library and the University Computer Center which contains a 370/155 computer. A Hewlett-Packard remote terminal computer system (HP 2000 E) is available for use by all students in the graduate programs.

Brigham Young University

Provo, Utah

Civil Engineering Department
College of Engineering and Technology

Environmental Engineering

ECPD Accredited--Civil Engineering and Master of Engineering

LaVere B. Merritt
Associate Professor of Civil Engineering
Civil Engineering Department
Brigham Young University
Provo, UT 84601
(801) 374-1211 x3036

June 1973

The emphasis of the environmental engineering graduate program at BYU is applied engineering design. However, considerable flexibility is possible in setting up an individual program so as to allow programs in water chemistry, process design, systems analysis and computer applications, biology, and public health engineering. BS, MEngr, MS, and PhD degrees are available.

Brigham Young University is a private university, owned and operated by The Church of Jesus Christ of Latter-day Saints (Mormon). Enrollment is 25,000 of which approximately 2300 are graduate students. Approximately 250 students are enrolled in the Civil Engineering Department. Student activity and involvement are excellent, e.g., the Student Chapter of ASCE has received the letter of commendation for twelve straight years and was selected the outstanding student chapter in the country for 1972. Tuition and fees are about $450 per semester for full-time students. BYU operates on a tri-semester program with the summer semester broken into two independent academic terms.

Brigham Young University is located at the foot of the majestic Wasatch Mountains in Central Utah, 50 miles south of Salt Lake City. Provo is a small city of 50,000 but is the cultural and activity center for Central Utah. Abundant outdoor recreation such as skiing, hiking, camping, fishing, and boating are available within a few minutes of the campus.

Admission Requirements

(a) 3.0/4 for graduate school, degree-seeking status.

(b) GRE is not required.

(c) Admission is allowed with a 2.5/4 on a provisional or non-degree basis.

(d) A minimum of 500 on the TOEFL or 80 percentile minimum on ALIGU is required. After admission the BYU English Placement must be taken, then corrective course(s) if weaknesses are determined.

(e) Any engineering discipline is acceptable. Chemistry, physics, and other science disciplines are also normally accepted.

(f) Students must have math through ordinary differential equations, fluid mechanics, and hydrology as prerequisite courses.

(g) The application must be reviewed by the Civil Engineering Department.

(h) PhD applicants reviewed by Civil Engineering Department and PhD Admission Committee.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MEngr	31S	No	No	21S	8
MS	31S	Yes[a]	No	21S	8
PhD (postmasters)	38S	Yes[b]	Yes[c]	18S	24

[a] 6-9 semester hours for thesis.

[b] 18 semester hours for dissertation.

[c] Several options are available, including a math-statistics-computer science substitution for foreign language.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 350	Environmental Engineering	Merritt	3S	S'73	15
CE 451	Sanitary Engineering	Fuhriman	3S	F'72	7
CE 550	Water Quality Management	Merritt	3S	Su'73	6
CE 652	Design of Water T. W.	Stutz	3S	S'73	12
CE 653	Design of Sewage T. W.	Stutz	3S	F'72	17
CE 654	Industrial Waste Treatment	Stutz	3S	S'73	12
CE 655	Sanitary Engineering Analysis	Merritt	3S	F'72	10
CE 694	Selected Problems	Staff	Varies	Su'73	2
Micro 311	Sanitary & Public Health	Staff	2S	Su'73	large
Micro 321	General Microbiology	Staff	3S	Su'73	large
Zoo 556	Limnology	White	3S	F'72	8
AgEc 450	Natural Resources Economics	Staff	3S	F'72	8

CE 451, CE 550, Micro 321 or equivalent are required of all graduate students.

Faculty

JAMES R. BARTON
Professor of Civil Engineering and Chairman
1967

BS	University of New Mexico	Civil Engineering	1944
MS	University of Colorado	Civil Engineering	1946
PhD	Colorado State University	Civil Engineering	1958

Hydraulics, fish and wildlife aquatic environment, water quality management

50% (25% research, 25% administration)

"Chemical Response of Utah Lake to Nutrient Inflow," Journal Water Pollution Control Federation, 45, 1973 (et al.)

"A Study of Some Alternative Methods of Eliminating the Salt Contribution of Crystal Geyser from the Green River." Report of Center for Environmental Studies, Brigham Young University, 1973 (with D. K. Fuhriman)

"Effects of Highway Construction of Fish Habitat on the Weber River," Rec-ERC 72-17, June 1972

"Lake Diking as a Water Pollution Management Tool," Environmental Protection Agency, 1970-73, assistant project director

"Fish Habitat in Weber River," Utah Department of Highways, 1969-73

"Crystal Geyser Research," USBR, 1972-73, project director

Registered professional engineer: Utah

Previous full-time professional experience: 18 yrs. (academic)

DEAN K. FUHRIMAN
Professor of Civil Engineering
1954

BS	Utah State University	Civil Engineering	1941
MS	Utah State University	Civil Engineering	1950
PhD	University of Wisconsin	Civil Engineering	1952

Hydrology, water quality management, facilities design

75% (50% teaching, 25% research)

"Chemical Response of Utah Lake to Nutrient Inflow," Journal Water Pollution Control Federation, 45 1973 (et al.)

"Groundwater Pollution in Arizona, California, Nevada, and Utah," Water Pollution Research Series-16060 EKU, December 1971, EPA (with J. R. Barton)

"A Study of Some Alternative Methods for Eliminating Salt Contribution of Crystal Geyser from the Green River," report to USBR, 1973

"Lake Diking as a Water Pollution Management Tool," Environmental Protection Agency, 1970-73, project director

"Crystal Geyser Research," USBR, 1972-73, principal investigator

Registered professional engineer: Utah and Nevada

Previous full-time professional experience: 8 yrs. (5 yrs. academic, 3 yrs. government)

Technical advisor, Division of Research Water Quality Programs, Environmental Protection Agency
Consultant and expert witness in numerous water resource and water quality projects and cases

LAVERE B. MERRITT
Associate Professor of Civil Engineering
1964

BS	University of Utah	Civil Engineering	1963
MS	University of Utah	Civil Engineering	1966
PhD	University of Washington	Civil Engineering	1970

Water quality management, system analysis and computer applications, modeling of water quality systems, facility design, water quality analysis

100% (75% teaching, 25% research)

"Computer-Based Design of Sewer Systems," Journal EED, ASCE, 99, EE1, 1973 (with R. H. Bogan)

"Simulation of the Annual Ecological Cycle of Benthic Marine Plants--Eelgrass in Izembek Lagoon Alaska," Proceedings of International Symposium on Math Modeling in Water Resource Systems, 1, Ottawa, Canada, 1972 (with C. P. McRay)

"Marginal Values of Dilution Waters," Water Resources Research, 5, 6, 1969 (with B. W. Mar)

"Lake Diking as a Water Pollution Management Tool," Environmental Protection Agency, 1970-73, principal investigator

"Time-Sharing Version of Opt. Sewer Design Program," Johns-Manville Corporation, 1972- , project director

Registered professional engineer: Washington and Utah

Previous full-time professional experience: 1 1/2 yrs. (1/2 yr. consulting and 1 yr. government)

CLIFFORD N. STUTZ
Professor of Civil Engineering
1969

BS	University of Utah	Civil Engineering	1932
MS	University of Illinois	Civil Engineering	1933

Industrial waste treatment, water and wastewater treatment, public health engineering

50% (50% teaching)

Industrial Wastes Manual, Brigham Young University Press, Provo, Utah, 1972

Registered professional engineer: Illinois and Utah

Previous full-time professional experience: 36 yrs. (15 yrs. consulting, 10 yrs. government, and 11 yrs. industry)

Industrial waste advisor, World Health Organization, 1968-73
Numerous consulting and advisory appointments

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT*	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	2	2	4	3	7	7	15	7	11	8	ENROLLMENT
	Doctoral	0	0	0	0	0	0	0	0	0	1	
Environmental Engineering	Master's	0	0	3	1	5	5	14	5	8	5	GRADUATES
	Doctoral	0	0	0	0	0	0	0	0	0	0	

*PT are students enrolled as minor students.

		Major	Minor	
Environmental Engineering	Master's	3	3	NON-US NATIONALS
	Doctoral	0	0	

	Master's	Doctoral	
Research assistantship	3	0	SUPPORT
Teaching assistantship	5	0	
Other university support	2	0	
Government employer	0	1	
Self	1	0	
Consulting	69	0	EMPLOYMENT (%)
Industry	8	0	
Federal government	8	0	
Other government	11	0	
Unknown	4	0	

Facilities

The engineering building (completed 1973) contains an environmental engineering research lab which includes a complete environmental room (programmable light, temperature, humidity) and a "white" room for low contamination research.

University of California-Berkeley

Berkeley, California

Department of Civil Engineering
College of Engineering

Sanitary Engineering

ECPD Accredited--MS in Sanitary Engineering

Professor Erman A. Pearson
Room 635 Davis Hall
Department of Civil Engineering
University of California
Berkeley, CA 94720
(415) 642-3741

January 1974

The specific objectives of the sanitary engineering education and research program at Berkeley are determined by the degree sought by the individual student. At the Master's Degree level, the objective is to educate graduate engineers, largely civil and chemical, in the relevant sciences, engineering theory, and design concepts so that they are qualified for professional practice in the sanitary engineering-water resource field or are able to undertake advanced study leading to the doctorate.

The objective of the doctoral program is to develop a well-educated engineer-scientist capable of creative and scholarly achievement in professional practice or in engineering education and research in the field of water quality management. To this end the student may pursue either the PhD degree where major emphasis is placed on academic work in the applied sciences and on original research, or the DEng in which greater attention is given to attaining a high proficiency in professional engineering work and a mastery of the appropriate scientific disciplines.

Currently, a new two-year MEng in sanitary engineering is under development.

Tuition and fees for full-time graduate students are: $232.50 per quarter for California residents; $732.50 per quarter for nonresidents of California; and $745.50 per quarter for foreign students (non-immigrant visa).

The University of California is a land-grant state university, being one of the nine campuses of the University of California Statewide System. Total enrollment at Berkeley is about 30,000 including some 9,000 graduate students. The College of Engineering has a current enrollment of about 2,900 and the Department of Civil Engineering, one of some 750. The Department of Civil Engineering, of which sanitary engineering is a part, was ranked top in the nation in 1971 in a survey conducted by the American Council on Education.

The University of California at Berkeley is located in the city of Berkeley at the foot of the Berkeley hills. Its beautifully wooded campus is close to the center of Berkeley and looks out across San Francisco Bay to San Francisco, some 15 miles away. For students desiring to combine their academic pursuits in an area that offers the widest variety of cultural and extramural interests, Berkeley is unsurpassed.

Admission Requirements

(a) 3.0/4 for MS and MEng, 3.5/4 for graduate PhD and DEng.

(b) GRE is not required.

(c) Admission to MS program is possible with GPA as low as 2.8/4 if strong letters of recommendation provided and solid explanation of reasons for GPA deficiency.

(d) Language examination/evaluation handled by English Department. If in their judgement grades are deficient, admission is denied. For borderline cases, special examinations are given and additional language requirements (i.e., formal courses) are required.

(e) Undergraduate disciplines acceptable include engineering graduates from ECPD accredited curricula, chemistry, and biology graduates.

(f) Non-engineers are required to make up core engineering and any requirements common to all engineering curricula if an engineering degree is sought. Core civil engineering requirements recommended for those desiring to become registered as civil engineers. For science majors not seeking engineering registration as a goal, an engineering science degree (curriculum) is available.

(g) Normally, three letters of recommendation requested; these are mandatory for those at or near minimum GPA requirement.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Sanitary Engineering	36	No	No	3Q	10
MEng--Sanitary Engineering	66	Yes	No	6Q	20
PhD--Sanitary Engineering	64	Yes	Yes	3[a]	44
DEng--Sanitary Engineering	66	Yes	Yes(1)	3[a]	44

[a] 3Q of residence required after passing qualifying exam.

[b] Comprehensive exam required of all Master's and doctoral students.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
Eng 150	Environmental Engineering: Air Pollution	Thomas Sawyer	3Q	S'73	40
Eng 151	Environmental Engineering: Water Pollution Control	Pearson Schrock	3Q	W'74	33
Eng 152	Environmental Engineering: Solid Waste Management	Golueke Hurlbut	3Q	S'73	25
Civil Eng 140	Water Resources Engineering	Selleck	4Q	F'73	37
Civil Eng 142	Design of Water Quality Mgt. Sys.	Pearson	3Q	S'72	9
Civil Eng 143	Applied Ecology	Horne	3Q	F'73	57
Civil Eng 144	Environmental & Sanitary Engineering	Oswald	3Q	W'74	51
Civil Eng 145	Chemistry of Waters	Thomas	3Q	F'73	31
Civil Eng 146A	Water Resources Chemistry	Jenkins	3Q	F'73	16

Civil Eng 146B	Water Resources Chemistry	Jenkins Thomas	2Q	W'74	18
Civil Eng 147	Organic Chemistry of Water & WW	Thomas	3Q	W'74	33
Civil Eng 201A	Physical Oceanography	Wilde	3Q	F'73	15
Civil Eng 201B	Chemical Oceanography	Wilde	3Q	W'74	14
Civil Eng 201C	Geological Oceanography	Wilde	3Q	S'73	9
Civil Eng 203A	Surface Water Hydrology	Todd	3Q	F'73	17
Civil Eng 203B	Ground Water Hydrology	Todd	3Q	W'74	20
Civil Eng 203C	Advanced Applied Hydrology	Todd	3Q	S'73	21
Civil Eng 209	Turbulent Mixing & Dispersion in the Hydrologic Environment	Fischer	2Q	W'74	6
Civil Eng 210	Water Resources: Quality	Pearson Selleck	3Q	F'73	20
Civil Eng 211	Water Treatment: Theory & Design	Selleck Pearson	3Q	W'74	24
Civil Eng 212	WW Treatment: Theory & Design	Pearson	3Q	S'73	34
Civil Eng 213	Water Resources Chemistry: Instrumental Methods	Jenkins Thomas	3Q	F'73	6
Civil Eng 214	Aquatic Chemistry	Jenkins	2Q	F'74	10
Civil Eng 215A	Adv. Sanitary Engineering Lab.	Pearson Selleck	2Q	W'74	24
Civil Eng 215B	Adv. Sanitary Engineering Lab.	Jenkins	2Q	S'73	28
Civil Eng 216	Industrial Waste Control	Pearson	3Q	S'73	22
Civil Eng 218A	Atmospheric Pollution	Tebbens	3Q	W'73	13
Civil Eng 218B	Atmospheric Pollution	Tebbens Thomas	-	S'73	9
Civil Eng 219	Solid Waste Management	Golueke	2Q	S'73	14
Civil Eng 290	Water Resources Development	Todd	2Q	S'73	21
Pub Health 156	Microbiology of Water & WW	Cooper	3Q	W'74	50
Pub Health 156	Water & WW Microbiology Lab.	Cooper	2Q	W'74	16
Pub Health 257	Biological Control Systems	Oswald	3Q	W'74	15

Civil Eng 143, 145, 146A, 146B, 210, 211, 212, 215A, 215B, and Pub Health 156 are required of all sanitary engineering majors with civil engineering undergraduate backgrounds.

Faculty

ERMAN A. PEARSON
Professor of Sanitary Engineering and Head
Department of Civil Engineering
1949

BS	University of Washington	Civil Engineering	1946
SM	Massachusetts Institute of Technology	Sanitary Engineering	1947
ScD	Massachusetts Institute of Technology	Sanitary Engineering	1949

Water resources-quality management, wastewater treatment-biological kinetics, industrial waste management, water treatment-filtration kinetics and mechanisms, marine waste disposal

100% (70% teaching, 20% research, 10% administration)

"Marine Waste Disposal Systems: Alternatives and Consequences," Chapter 10 in Coastal Zone Management, John Wiley and Sons, 1972 (J. F. P. Brahtz, ed.)

"Water Resource Quality Management: The Future--Realism or Folly," Chapter in Civil Engineering Frontiers in Environmental Technology, University of California, Berkeley, Department of Civil Engineering, pp. 11-24, 1971

"Biostimulation Enrichment Methods and Interpretation," Report of Polytechnic di Milano Italia, Trieste Conference Proceedings, Morina Aurisma, Trieste, pp. 67-79, 1973 (with C. H. Huang)

"Kinetics of Biological Treatment," chapter in Advances in Water Quality Improvement, University of Texas Press, pp. 381-394, 1968 (E. F. Gloyna and W. W. Eckenfelder, eds.)

"Filtration Kinetics in Water and Wastewater," Environmental Protection Agency, 8/69-7/72, principal investigator

"Comprehensive Studies of San Francisco Bay," California State Water Resources Control Board, 7/59-9/70, principal and co-principal investigator

"Provisional Algal Assay Procedures," Environmental Protection Agency, 7/69-7/71, principal investigator

Registered professional engineer: California and Washington

Previous full-time professional experience: 4 yrs. (1/2 yr. government, 3 1/2 yrs. industry)

Member, AEEP
Diplomate, AAEE
Past President, International Association on Water Pollution Research (1966-70)
First President, American Association of Professors in Sanitary Engineering (1963-65)
Member, Governor's Advisory Commission Marine and Coastal Resources, Sacramento, California (1966-72)
Member, Science Advisory Committee, US Coast Guard, Washington, DC (1972-date)
Member, National Academy of Engineering Marine Board (1969-date)

ALEXANDER J. HORNE
Assistant Professor of Aquatic Biology
Department of Civil Engineering and Sanitary Engineering Research Laboratory
1971

BSc	Bristol University, England	Biological Chemistry	1964
PhD	Universities of London and Dundee, England	Limnology and Oceanography	1969

Aquatic ecology, algal physiology, toxicants and biostimulants in aquatic environment, nitrogen fixation

100% (60% research, 40% teaching)

"Nitrogen Fixation in Clear Lake, California. I. Seasonal Cycles and the Role of Heterocysts," Limnology and Oceanography, 17, p. 678, 1972 (with C. R. Goldman)

"Primary Production in an Area of Inshore Antarctic Sea," Journal Marine Biological Association, 49, p. 393, 1969 (with G. E. Fogg and D. J. Eagle)

"Recent Studies on the Role of Nitrogen in the Biostimulation and Eutrophication of Aquatic Ecosystems," Proceedings Seminar on Eutrophication and Biostimulation, California Department of Water Resources, Sacramento, p. 55, 1972

"Long-term Effects of Toxicants and Biostimulants on the Water of Central San Francisco Bay," University of California, Berkeley, Sanitary Engineering Research Laboratory, SERL Report 73-1, 1973 (with R. W. Stone and W. J. Kaufman)

"Remote Sensing and Large-Scale Movements of Nuisance Algal Blooms in Eutrophic Water Bodies as Related to 'Water Truth' Measurements," National Aeronautics and Space Administration, 1964-65, principal investigator

"Biostimulation and Toxicity of Industrial Wastes on San Francisco Bay Algae," Standard Oil Company of California, 1973-75, co-investigator

Previous full-time professional experience: 2 yrs. (research)

Reviewer for Limnology and Oceanography (1971-present)
Consultant, California State Department of Water Resources

DAVID JENKINS
Associate Professor of Sanitary Engineering
and Acting Director of Sanitary Engineering Research Laboratory
Department of Civil Engineering
1960

BSc	University of Birmingham, England	Applied Biochemistry	1957
PhD	University of Durham, King's College, England	Public Health Engineering	1960

Chemical and biochemical aspects of natural waters, wastewaters and water and wastewater treatment processes, fate of pesticides in the environment

100% (40% teaching, 30% research, 30% administration)

Water Chemistry Laboratory Manual, Association of Environmental Engineering Professors, 1974 (with V. L. Snoeyink, J. F. Ferguson, and J. O. Leckie)

"Calcium Phosphate Precipitation at Slightly Alkaline pH Values," Journal Water Pollution Control Federation, 45, p. 620, April 1973 (with J. F. Ferguson and J. Eastman)

"Environmental Impact of Detergent Builders on the Waters of the State of California," Water Research, 7, p. 265, 1973 (with W. J. Kaufman, A. J. Horne, and P. H. McGauhey)

"Physical Conditioning of the Activated Sludge Floc," Journal Water Pollution Control Federation, 43, p. 1817 (with D. S. Parker and W. J. Kaufman)

"The Mechanism and Design of the Contact Stabilization Activated Sludge Process," Advances in Water Pollution Research, 6th International Conference held in Jerusalem, June 8-23, 1972, Pergamon Press, pp. 353-362 (with D. Orhon)

"Translocation, Accumulation and Degradation of Pesticides at Land Wastewater Disposal Sites," US Army Medical Research and Development Command, 5/73-5/74, principal investigator

"Occupational Exposure to Organophosphorous Compounds," National Institutes of Occupational Health and Safety, 2/72-1/75, co-investigator

"Environmental Toxicology of Selected Compounds to Fish and Aquatic Biota," 2/74-8/75, co-principal investigator

Registered professional chemist: Great Britain

Member, AEEP; Board of Directors (1971-74)
Vice-Chairman, Standard Methods Committee, Water Pollution Control Federation
Member, Editorial Board, Environmental Science and Technology, American Chemical Society (1971-date)
Chairman, Research Committee on Organic Matter in Water Supplies, American Water Works Association (1972-date)
Member, Research Committee, Water Pollution Control Federation (1973-date)

WILLIAM J. OSWALD
Professor of Public Health and Sanitary Engineering
Department of Civil Engineering and School of Public Health
1950

BS	University of California-Berkeley	Civil Engineering	1950
MS	University of California-Berkeley	Sanitary Engineering	1951
PhD	University of California-Berkeley	Sanitary Engineering	1957

Applied algology, water quality management, waste treatment plant design, water treatment plant design, limnology

100% (50% teaching, 40% research, 10% administration)

"Productivity of Algae in Sewage Disposal," Journal Solar Energy, Pergamon Press, Great Britain, 15, 1973

"Ecological Management of Thermal Discharges," Journal Environmental Quality, 2, April-June 1973

"Algal Reactor for Life Support System," Journal Sanitary Engineering Division, Proceedings of American Society of Civil Engineers, February 1970 (with G. Shelef and P. H. McGauhey)

"Microbiological Transformation of Solar Energy," RANN, National Science Foundation, 4/73-4/75, principal investigator

Registered professional engineer: California

Member, American Society of Civil Engineers
Member, National Society of Professional Engineers
Member, American Society of Sugar Beet Technology
Member, American Society of Limnology and Oceanography
Member, International Association for Water Pollution Research

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ROBERT E. SELLECK
Professor of Sanitary Engineering
Department of Civil Engineering
1961

BS	Case Institute of Technology	Civil Engineering	1950
MS	Case Institute of Technology	Civil Engineering	1955
PhD	University of California-Berkeley	Sanitary Engineering	1962

Water and wastewater engineering, hydrology, disinfection of water and wastewater, water treatment unit processes, marine surface flotage from submerged outfalls, biological effects of treated wastewaters on the aquatic environment

100% (40% teaching, 30% research, 30% administration)

"Toxicity Assessment of Treated Municipal Wastewaters," Journal Water Pollution Control Federation, 45, p. 1558, July 1973 (with L. A. Esvelt and W. J. Kaufman)

"Problems in Obtaining Adequate Sewage Disinfection," Journal Sanitary Engineering Division, American Society of Civil Engineers, 97, SA5, October 1971 (with H. F. Collins and G. C. White)

"A Kinetic Model of Fish Toxicity Threshold," Journal Water Pollution Control Federation, 41, R294, 1969 (with C. W. Chen)

"The Significance and Control of Wastewater Floatables in Coastal Waters," Environmental Protection Agency, 10/72-12/73, principal investigator

"Surface Phenomena Study," Southern California Coastal Water Research Project, 3/71-6/72, principal investigator

"Biological Effects of Treated Effluents on the Truckee River," State of California Water Resources Control Board, 7/72-6/73, principal investigator

Registered professional engineer: Ohio

Previous full-time professional experience: 4 yrs. (1 yr. industry, 1 yr. consulting, 1 yr. government, and 1 yr. academic)

Member, AEEP
Member, Program Committee, International Association of Water Pollution Research (1974)
Member, Research Committee, Water Pollution Control Federation (1969-71)
Consultant, Pan American Health Organization (1969 and 1971)

BERNARD D. TEBBENS
Professor of Industrial Hygiene Engineering
School of Public Health and Department of Civil Engineering
1948

AB	Grinell College, Iowa	Chemistry	1931
MS	Brown University	Chemistry	1938
ScD	Harvard University	Industrial Hygiene Engineering	1946

Air pollution engineering, industrial hygiene engineering, environmental health

100% (50% teaching, 25% research, 25% administration)

"Fate of Arenes Incorporated with Airborne Soot: Effect of Irradiation," American Industrial Hygiene Journal, 32, June 1971 (with M. Mukai and J. F. Thomas)

"Quality Control of Work Environments," American Industrial Hygiene Journal, 32, August 1971 (with R. C. Spear)

"Personal Dosimetry Versus Environmental Monitoring," Journal Occupational Medicine, 15, August 1973

"Evaluation of the Effects of Heat Radiation on Man," American Industrial Hygiene Journal, 33, November 1972 (with U. Reischl)

"Environmental Health Training Grant," National Institute for Occupational Safety and Health, 7/1/66-6/30/76, program director

Previous full-time professional experience: 12 yrs. (6 yrs. government and 6 yrs. industry)

Board of Directors, American Industrial Hygiene Associate
Advisory Council Member, Bay Area Air Pollution Control District
Consultant, State Department of Health, California

JEROME F. THOMAS
Professor of Sanitary Chemistry
Department of Civil Engineering
1950

BS	DePaul University, Chicago	Chemistry	1942
PhD	University of California-Berkeley	Chemistry	1950

Chemical aspects of water and air pollution and quality control

100% (50% teaching, 40% research, 10% administration)

"A Discussion of the Chemical Character of Water Mixtures," Journal American Water Works Association, 63, January 1971 (with R. R. Trussell)

"The Influence of Henry's Law on Bicarbonate Equilibria," Journal American Water Works Association, 62, March 1970 (with R. R. Trussell)

"Computer Application to Water Conditioning Calculations," Journal American Water Works Association, 62, April 1970 (with R. R. Trussell)

"Analysis of Sulfur-Containing and Sulfur-Free Organic Products Formed in Kraft Black Liquor Pyrolysis," Technical Association of Pulp and Paper Industry Journal, December 1970 (with D. L. Brink and A. A. Pohlman)

"Pyrolysis-Combustion, Air Pollution Control for the Kraft Recovery Process," Environmental Protection Agency, 7/65-6/74, co-principal investigator

"NSF Fire Research Project," National Science Foundation, 6/71-8/76, co-faculty investigator

"Evaluation of Emissions from Asphalt Roofing Kettles with Respect to Air Pollution," National Asphalt Institute, 7/62-6/73, principal investigator

Adjunct Professor, Environmental Protection Agency
Consultant, National Academy of Science on Air and Water Pollution
Consultant, Atomic Energy Commission on Water Conditioning Problems and Air Pollution Control
Consultant, Cities of San Francisco, Berkeley, and Albany on water treatment problems

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TERRY R. GALLOWAY
Lecturer in Sanitary Engineering and Assistant Director, Sanitary Engineering Research Laboratory
Department of Civil Engineering
1972

BS	University of California-Berkeley	Chemical Engineering	1962
MS	California Institute of Technology	Chemical Engineering	1963
PhD	California Institute of Technology	Chemical Engineering	1967

Wastewater treatment unit operations, modeling of environmental systems, water resources systems analysis, transport phenomena

100% (40% teaching, 20% research, 40% administration)

"Bioassessment Techniques for Setting Environmentally Safe Levels of Tertiary Treatment Nutrient Removal," Chemical Engineering Symposium Series, Water, 1974 (with H. P. Skarheim and R. E. Selleck)

"Assessment of Biological Effects of Treated Wastewaters on the Truckee River," University of California, Berkeley, Sanitary Engineering Research Lab, SERL Report 73-2, June 1972 (with H. P. Skarheim and R. E. Selleck)

"Evaluation of the Effectiveness of the Lead Peroxide Method for Atmospheric Monitoring of Sulfur Dioxide," Journal Air Pollution Control Association, 33, p. 605, 1973 (with S. F. Liang and C. V. Sternling)

"Contributions of Urban Air Pollution on Atmospheric Extinction Measures," paper presented to American Institute of Chemical Engineers, Vancouver, BC, September 1973 (with S. T. Massie)

"Particulate Control Design Package (PART PK) Removal of Aerosols from Gas Streams," Shell Development Corp., Emeryville, California, Technical Progress Report 33-72, July 1972 (et al.)

"Assessment of Biological Effects of Treated Wastewater on the Truckee River, California," California State Water Resources Control Board, 8/72-6/73, project manager

Previous full-time professional experience: 5 yrs. (industry)

American Institute of Chemical Engineers, Subcommittee on Chemical Engineering Education: Computers in Process Design (1971-72)
Project Leader, Chabot Observatory, Air Pollution Particulates Monitoring through Optical Spectroscopy in cooperation with University of Washington, Project ASTRA (Astronomical and Space Techniques for Research on the Atmosphere) (1971-date)
Representative of Astronomical Society of the Pacific to the Astronomical Association of Northern California (1971-date)
Member, Special Earthquake Safety Study Team for Oakland Public Schools (1971-date)
Board of Director, East Bay Astronomical Society, Oakland (1970-date)

CLARENCE G. GOLUEKE
Lecturer in Sanitary Engineering and Research Biologist, Sanitary Engineering Research Laboratory
1952

BA	St. Louis University	Zoology	1939
MS	University of Illinois	Ecology	1941
PhD	University of California Berkeley	Mycology	1952

Wastewater treatment and reclamation, application of photosynthesis to waste treatment and solar energy conversion, solid waste management

100% (15% teaching, 80% research, 5% administration)

"Composting--A Study of the Process and Its Principles," Rodale Press, Inc., March 1973

"Critical Review of the Literature in Solid Waste Management," CRC, Critical Review in Environmental Series, Chemical Rubber Publishers, pp. 261-301, May 1973

"Harvesting and Processing Sewage-Grown Planktonic Algae," Journal Water Pollution Control Federation, 37, p. 471, 1965 (with W. J. Oswald)

"Role of Plants in Closed Systems," Annual Review of Plant Physiology, 15, p. 387, 1964

"Biological Conversion of Light Energy to the Chemical Energy of Methane," Applied Microbiology, 1, p. 219, 1959

"Effect of Disposable Diapers on Leachate from Sanitary Landfills," The Proctor and Gamble Company, 6/72-3/74, co-investigator

"Solar Energy Fixation and Conversion with Algal-Bacterial Systems," National Science Foundation, 5/73-5/75, co-principal investigator

Member, Editorial Board of Compost Science (1960-date)
Member, Editorial Board of Environmental Letters (1960-date)
Member, American Society of Testing Materials, Committee on Resource Recovery (1973-date)
Consultant, US Department of Health, Education and Welfare, Engineering and Urban Health Study Section (1965-69)
Consultant, Environmental Protection Agency, Solid Waste Management Office (1969-73)

ROBERT C. COOPER
Associate Professor of Public Health
Chairman, Division of Environmental Health Sciences, School of Public Health
PhD Michigan State University Microbiology and Public Health 1958
Environmental health sciences, microbiological aspects of water quality, water hygiene
100%

PAT WILDE
Assistant Professor of Hydraulic Engineering, Department of Civil Engineering
Assistant Research Oceanographer, Sanitary Engineering Research Laboratory and Institute of Marine Resources
PhD Harvard University Geology 1965
Monitoring of chemical parameters in marine waters, sediment transport in marine environment, waste disposal in the ocean
100%

HUGO B. FISCHER
Associate Professor of Civil Engineering
Department of Civil Engineering
PhD California Institute of Technology Hydraulic Engineering 1966
Mixing, dispersion and transport of pollutants in the aquatic environment, water resources
100%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Sanitary Engineering	Master's	10	0	29	0	32	1	34	0	25	0	ENROLLMENT
	Doctoral	34	1	26	1	20	2	17	1	20	2	
Sanitary Engineering	Master's	10		21		31		28		5*		GRADUATES
	Doctoral	2		5		8		3		2*		
Sanitary Engineering	Master's	1		NON-US NATIONALS								
	Doctoral	9										

	Master's	Doctoral	
EPA traineeship	15	1	SUPPORT
Other traineeship	1	4	
Research assistantship	0	2	
Teaching assistantship	0	2	
Other university support	0	1	
Foundation support	0	1	
Government employer	1	0	
Consultant employer	1	3	
Self-supported	7	4	
Consulting	33	59	EMPLOYMENT (%)
Federal government	4	5	
Other government	23	9	
Academic	4	27	
Further study	9	0	
Military	3	0	
Unknown	24	0	

*September-December 1973 only.

Facilities

Facilities and opportunities for the conduct of research during graduate study at Berkeley are outstanding. On the Berkeley campus, sanitary engineering has 5000 sq ft of laboratory space in the recently completed Davis Hall, as well as a process engineering laboratory in O'Brien Hall that includes aeration, coagulation-flocculation, sedimentation and filtration pilot plants. At the Richmond Field Station, seven miles to the north on the shores of the San Francisco Bay, the Sanitary Engineering Research Laboratory offers the student 22,000 sq ft of laboratories and several acres of pilot plant facilities. Here the most sophisticated laboratory equipment and analytical instrumentation are available to the student and researcher. The laboratory operates its own fully-instrumented pilot-scale (5 gpm) wastewater treatment plant which includes primary sedimentation, activated sludge units, trickling filters, chlorination facilities, a 2/3-acre high-rate oxidation pond, a 1/4-acre facultative pond, and a complete chemical waste treatment plant.

University of California-Irvine

Irvine, California

Environmental and Resources Engineering
School of Engineering

Civil and Environmental Engineering

1868

Dr. Jan Scherfig
School of Engineering
University of California
Irvine, CA 92664
(714) 833-5333

February 1974

The program in civil and environmental engineering emphasizes the application of engineering principles and practice to the elements of the environment in order to protect and improve society and man's health. Graduate programs leading to the MS and PhD in engineering are offered in water quality engineering, water resources engineering, air resources engineering, and environmental systems planning and optimization.

The University of California-Irvine is located in Orange County, 40 miles south of Los Angeles and three miles inland from the Pacific Ocean. The surrounding hills and grazing land give the campus a rural feeling even though an estimated two million people live within a 20-mile radius. In the fall 1972, 7384 students were enrolled, 1574 of them graduate students.

The environmental engineering program has close ties with the Population and Environmental Biology Department, the Graduate School of Administration, and the School of Medicine (health effects). The Pacific Southwest Air Pollution Association enables UCI to utilize faculty resources in air resources from nearby University of California-Riverside, University of California-Los Angeles, and the University of Southern California. The program has a close cooperation with the Irvine Ranch Water District providing large scale water, wastewater, and reclamation facilities for field studies.

Admission Requirements

(a) 3.0/4 for MS; 3.5/4 on Master's work or 3.25/4 overall for PhD.

(b) GRE of 1000 (verbal and quantitative only) combined is required for MS; GRE of 1000 (do not require advanced) combined is required for PhD.

(c) Admission to MS program is possible for GPA down to 2.5/4. Students must take remedial courses and obtain satisfactory grades.

(d) No language examination is required for foreign students.

(e) Any engineering discipline is acceptable. Individuals with undergraduate degrees in chemistry, biology, mathematics, and physics are normally acceptable.

(f) Nonengineers must take the undergraduate core courses or pass an examination based on these courses.

(g) Applicants must have three letters of recommendation submitted.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	36Q	Optional	No	-	9
PhD	[a]	Yes	No	6Q	36-48

[a] No specific course requirements but rather several milestones: passage of the preliminary examination assessing the student's background and his potential for success in the doctoral program; satisfaction of the one-year teaching requirement (normally satisfied by being a teaching assistant); research preparation; and completion of a significant research investigation.

Course Work

Designation	Title	Instructor	Credit	Last Pres.	Enrollment
E263ABC	Water & Air Resources Technology	Staff	12Q	72-73	10
E265	Water & Air Treatment Chemistry	Staff	4Q	71	7
E266	Public Health	Staff	4Q	S'73	15
E268AB	Environmental Resources Systems	Scherfig	8Q	FW'72	7
E270	Combustion	Samuelsen	4Q	-	5
E258AB	Flow in Open Channels	Brock	8Q	FW'72	2
E275	Advanced Transportation	Staff	4Q	S'73	5
E264	Advanced Air Pollution Control	Staff	4Q	S'73	11
E267	Design Environmental Systems	Staff	4Q	S'73	11
E269	Advanced Noise Control	Wooten	4Q	S'73	3
E161	Introduction to Environmental Engr.	Staff	4Q	F'72	35
E162	Water & Waste Systems	Brock	4Q	W'73	5
E163	Water & Waste Treatment	Scherfig	4Q	S'73	20
E164	Air Pollution	Samuelsen	4Q	W'73	30
E165	Environmental Engineering Aspects of Physical Chemistry & Thermodynamics	Staff	-	W'73	5

E168AB	Socio-Political, Economic & Legalistics Aspects of Environ. Engr.	Staff	4Q	WS'73	20
E169	Noise Control	Wooten	4Q	W'73	11
E198	Desalination	Staff	-	W'71	15
BioSci 203	Population & Environ. Biology	Dixon	4Q	W'71	25
SocSci 133K	Trans. Theory	Werner	4Q	'72	20

E263ABC and E267 required of all MS and PhD students.

Faculty

JAN SCHERFIG
Associate Professor
Civil and Environmental Engineering
1967

MS	Danish Technical University, Copenhagen	Chemical Engineering	1959
PhD	University of California-Berkeley	Sanitary Engineering	1968

"Evaluation of Various Materials for Use in Algal Culture Systems," Hydrobiologia, March 1972 (et al.)

"Application of Adsorptive Bubble Separation Techniques to Waste-Water Treatment," Adsorptive Bubble Separation Techniques, Academic Press, 1972 (et al.)

"Marine Waste Disposal at Rio de Janeiro--Water Quality Evaluations and Design," Advances in Water Pollution Research, 1970 (with C. E. Peixoto and C. A. Volpi)

"Evaluation of Algal Assay Procedures," Journal Water Pollution Control Federation, October 1971 (with Steven Murry)

"Algal Assay Procedures: Bottle Test," a cooperative effort with other government, university, and industrial laboratories, National Eutrophication Research Program--Environmental Protection Agency, August 1971

Previous full-time professional experience: 9 yrs. (2 yrs. academic, 3 yrs. research, 2 yrs. industry, 2 yrs. government)

Member AEEP
Member, American Institute of Chemical Engineers
Member, Danish Engineering Society
Member, Water Pollution Control Federation
Member, American Society of Civil Engineers

G. SCOTT SAMUELSEN
Chairman of Environmental and Resources Engineering and
Assistant Professor of Mechanical Engineering
1970

BS	University of California-Berkeley	1964
MS	University of California-Berkeley	1965
PhD	University of California-Berkeley	1970

"Flame Propagation Rates in the Combustion of Ammonia-Air Mixtures at High Pressures," Eleventh Symposium (International) on Combustion, 1967 (with E. S. Starkman)

"Response and Failure of Plastic Shells Under Transient Surface Pressures," American Institute of Aeronautics and Astronautics Journal, 9, 11, 1971 (with W. Stuver)

"Analytical and Experimental Study of an Ammonia-Air Opposed Reacting Jet," Combustion Science and Technology, 5, pp. 31-41 (with E. S. Starkman)

"Air Quality: Who is Responsible?," California Air Environment, 2, 4, October/December 1971

Previous full-time professional experience: 8 yrs. (1 yr. industry and 7 yrs. research)

Member, TAU BETA PI
Member, SIGMA Xi
Member, Combustion Institute
Member, Pacific Southwest University Air Pollution Association
Chairman, (UCI, UCLA, UCR, USC) Executive Committee and Board of Directors

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GERARD C. PARDOEN
Assistant Professor
Civil and Environmental Engineering
1973

BS	University of Pennsylvania	Civil Engineering	1966
MS	Stanford University	Civil Engineering	1967
PhD	Stanford University	Civil Engineering	1969

"Motion of a Rigid Body with Respect to a Global Coordinate System," SM-028, Aeronutronic Division, January 1970

"Modal Analysis of a Discretized Structural System," SM-073, Aeronutronic Division, June 1970

"Initial Velocities of a Constrained Structure Due to Impulsive Forces," submitted to American Institute of Aeronautics and Astronautics Journal

"Deflection Function for the Symmetrical Bending of Circular Plates," American Institute of Aeronautics and Astronautics, 10, 2, February 1972

"Buckling of Thin-Walled Columns Using Finite Elements," submitted to Journal of Computers and Structures

Previous full-time professional experience: 8 yrs. (4 yrs. academic and 4 yrs. industry)

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Civil &	Master's	-	-	-	-	-	-	-	-	15	10	ENROLLMENT
Envir. Engr.	Doctoral	-	-	-	-	-	-	-	-	3	0	

		69-70	70-71	71-72	72-73	73-74	
Civil &	Master's	-	3	26	8	-	GRADUATES
Envir. Engr.	Doctoral	-	0	1	1	-	

EPA traineeship	5	SUPPORT
Research assistant	4	
Teaching assistant	7	
Other university support	1	

	Master's	Doctoral	
Government agency	15	0	EMPLOYMENT (%)
Government service	18	0	
Industry	48	0	
Other	18	0	
University	0	33	
Government	0	66	

Facilities

Facilities at the University of California-Irvine include a five-meter long sand model for study of two-dimensional ground water flow. A continuous combustor facility with monitoring instrumentation for CO, CO_2, O_2, NO-NO_x, total hydrocarbons, separation of hydrocarbons and particulates and laser doppler anemometer is available for student and faculty research activities. Also available at the university are stack monitoring instrumentation for continuous dry and wet analysis of particulates, CO, XO_x, and NO-NO_x; ambient monitoring including continuing ozone and ambient gas chromatographic analyzers; a total organic carbon analyzer-particle counter; and an atomic absorption unit with heated graphic furnace for determining micro quantities of metals.

California State University-Sacramento

Sacramento, California

Department of Civil Engineering
School of Engineering

Civil Engineering

ECPD Accredited--Civil Engineering

Dr. Kenneth D. Kerri, Program Director
Professor of Civil Engineering
California State University-Sacramento
6000 Jay Street
Sacramento, CA 95819
(916) 454-6142

May 1973

In the water resources and water quality engineering program emphasis is placed on the identification and development of water resources and on the design of water resource systems to furnish sufficient quantities of water of suitable quality to meet the demands of beneficial uses. Subject matter in the curriculum includes statistical evaluation of data and design of experiments, economic analysis, simulation, re-use of wastewater, establishment of water quality criteria, water quality analysis, and sanitary engineering design. The program is designed to permit the student to stress his interests in the political, administrative, planning, field investigation, design or research aspects of water resource development and water quality management.

The air pollution engineering program is aimed at the identification of the problems, the measurement of their magnitudes, and the application of technological controls. The curriculum includes course work in statistical evaluation of data and design of experiments, meteorology, incineration, and combustion as well as the courses in air pollution control, measurements, and atmospheric aerosols.

Unique opportunities are provided by nearby rivers and lakes. The American River flows by the campus and is a relatively clear, fast-flowing stream in comparison with the Sacramento River. Temperatures in the American River can be regulated by controlled releases from Folsom Lake. Other nearby lakes available for field investigation include Clear Lake and Lake Tahoe. The California Department of Fish and Game has offered space for graduate research in its pollution bioassay lab located at the nearby Nimbus Hatchery. Students have received financial support from state and federal agencies for working on cooperative studies. Environmental internships with the California Legislature are available for students interested in working on the technical and legal aspects of the environment.

Admission Requirements

(a) A minimum engineering undergraduate GPA of 3.0/4.

(c) Provisional acceptance is possible with an engineering undergraduate GPA of 2.5/4.

(e) Any engineering discipline at an accredited institution is acceptable. Individuals with BS degrees may be admitted to regular MS program if they complete basic engineering courses or they may enter the interdisciplinary program if interdisciplinary committee approves the student's proposed course schedule.

(f) Nonengineers and some engineering majors are required to take undergraduate prerequisites (CE 170 Sanitary Engineering) without credit during the first semester.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MSEngr--Civil Engr.	30S	Optional	No	2S	12

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 136	Water Resources Engineering	Packer	-	F'72	23
CE 139	Intermediate Hydraulic Theory	Neuman	-	S'73	14
CE 170	Sanitary Engineering	Hom	-	S'73	34
CE 172	Water Quality Analysis	Hom	-	F'72	12
CE 173	Water Quality Engineering Design	Hom	-	S'73	8
CE 176	Urban Engineering	Neuman	-	S'73	21
CE 177	Atmospheric Pollution Control	Tomine	-	F'72	14
CE 178	Environmental Engineering	Kerri	-	S'73	17
CE 250B	Systems Analysis	Kerri	-	S'73	18
CE 251	Water Quality Management & Control	McLaren	-	F'72	22
CE 252	Environmental Quality Treat. Proc.	Hom	-	F'72	18
CE 252A	Water Quality Unit Oper. & Proc.	Hom	-	F'72	18
CE 253	Advanced Water Quality Analysis	Hom	-	S'73	14
CE 255	Solid Waste Management	Rogers	-	F'72	23
CE 270A	Hydrology	Packer	-	F'72	12
CE 273A	Hydraulic Theory	Prasuhn	-	F'72	5
CE 273B	Hydraulic Theory	Prasuhn	-	S'71	7
CE 296	Resource Planning	Johnson	-	F'72	14
E 200C	Engineering Statistics	Miyogi	-	S'73	22
E 200D	Operations Research	Luther	-	F'72	23
E 224	Environmental Quality Management	Kerri	-	S'72	21
E 225	Remote Sensing of Environ. Quality	Janza	-	S'73	7
E 226	Air Quality Measurements	Tomine	-	S'73	12
E 227	Atmospheric Aerosols	Tomine	-	F'72	8
ME 193	Incineration, Air Poll. & Waste Dis.	Reardon	-	S'72	14
ME 261	Combustion	Reardon	-	F'72	6

BS 140	Sanitation Microbiology	Calderone	-	F'71	14
Geog 110	Meteorology	Fitzwater	-	F'72	18
Geog 111	Meteorology Lab	Fitzwater	-	F'72	18
Chem 140A-B	Physical Chemistry	Sime	-	72-73	16
Chem 197A-B	Instrumental Technology	Jakob	-	72-73	16
ES 114	Environmental Impact Reports	Washburn	-	S'73	25
Gov 296	Environmental Internship	McDaniel	-	S'73	12
Econ 128	Environmental Economics	Scheel	-	F'72	25

E 200C, E 200D or approved math course; CE 252; and CE 251 or E 224 are required courses.

Faculty

LEONARD W. HOM
Professor of Civil Engineering
Civil Engineering Department
1963

BS	University of California-Berkeley
MS	University of California-Berkeley
PhD	University of California-Berkeley

Water and wastewater engineering, disinfection and photosynthetic processes, water quality, pollution potential and pollution control, remote sensing systems for environmental control

100% (80% teaching, 20% research)

"Kinetics of Chlorine Disinfection in an Ecosystem," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, 183-191, February 1972

"Potential for Pollution from Animal Agriculture," American Society of Agricultural Engineers Pacific Region Conference, February 1970

"American River Hydrobiologic Potential," US Bureau of Reclamation Report No. 2-710, 1968

"Remote Sensing of Water Pollution," Journal Water Pollution Control Federation, 40, 1728-38, 1968

"Effectiveness of Wastewater Treatment Ponds in Removing Nutrients at Lake Berryessa," US Bureau of Reclamation, 7/72-present, co-investigator

"Chlorine Disinfection of Ponded Ecosystems," SSU Foundation, 7/71-present, principal investigator

"Evaluation of Pollution Potential of Concentrated Animal Wastes," California WRCB, 7/69-6/71, principal investigator

Registered professional engineer: California

Diplomate, AAEE
Member, American Society of Civil Engineers
Member, American Society for Engineering Education
Member and past committee chairman, Water Pollution Control Association
Who's Who in the West

KENNETH D. KERRI
Professor of Civil Engineering
Civil Engineering Department
1959

BS	Oregon State University
MS	University of California-Berkeley
PhD	Oregon State University

Applications of systems analysis to water resource system, environmental engineering

100% (80% teaching, 20% research)

"Operation of Wastewater Treatment Plants," Environmental Protection Agency, Office of Water Programs, 1971 (et al.)

"Complementary-Competitive Aspects of Water Storage," for Federal Water Pollution Control Administration, DAST-1, Sacramento, December 1969

"Environmental Assessment of Resource Development," Journal Sanitary Engineering Division, American Society of Civil Engineers, 90, SA2, April 1972

"Development of a Field Study Program for Waste Treatment Plant Operators," Water and Sewage Works, 119, 7

"Operation of Wastewater Treatment Plants," Environmental Protection Agency, 5/68-present, principal investigator

"A Study of the Effectiveness of Wastewater Treatment Ponds in Removing Nutrients at Lake Berryessa," Bureau of Reclamation, 7/72-present, principal investigator

Registered professional engineer: California

Member, AEEP
Diplomate, AAEE
Member, Advisory Committee for Operator Certification, State Water Resources Control Board

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WILLIAM R. NEUMAN
Professor of Civil Engineering
Civil Engineering Department
1962

BS	Sacramento State College
MS	Stanford University

Hydraulics, hydrology, engineering economics

100% (80% teaching, 20% research)

"Daily Streamflow Simulation," Transaction of the Hydraulics Division, American Society of Civil Engineers, July 1969 (with Kerri and Payne)

"Proposed Orchard Standards," Spink Corporation, May 1969

"Arden-Fulton Drainage Structure," Sacramento County, 1965

Registered professional engineer: California

MURLAND R. PACKER
Assistant Professor of Civil Engineering
Civil Engineering Department
1969

BS	Utah State University
MS	Utah State University
PhD	Utah State University

Hydrology and water resources, engineering economics, and statistics

100% (80% teaching, 20% research)

"Simulation of the Hydrologic-Economic Flow System in an Agricultural Area," Utah Water Research Laboratory Pub. No. PRW 657-1, Logan, UT, 1969

"Simulation of the Hydrologic-Economic Flow System," The Use of Analog and Digital Computers in Hydrology, Vol. II, Pub. No. 81, International Association of Scientific Hydrology Proceedings, 1968

"Analysis of Streamflow Forecasting Uncertainty," *Proceedings* of the International Symposium on Uncertainties in Hydrologic and Water Resources Systems, *I*, 115-125, December 1972

"Analysis of Streamflow Forecasting Accuracy," a report published by Sacramento State University Foundation (97 pages), April 1972

Registered professional engineer: California

ALAN L. PRASUHN
Associate Professor of Civil Engineering
Civil Engineering Department
1968

BS	Ohio State University
MS	State University of Iowa
PhD	University of Connecticut

Hydraulic engineering, fluid mechanics, sedimentation, turbulence

100% (80% teaching, 20% research)

"Turbulence Measurements Over an Alluvial Bed," *Proceedings* of the Sedimentation Symposium, Berkeley, CA, June 1971 (with Lerseth)

"Modeling and Analysis of Floods through Flood Plains," *Proceedings* of the International Symposium on River Mechanics, International Association for Hydraulic Research, Bangkok, Thailand, January 1973

"Turbulence Measurements over Sand Beds," *Proceedings* of the International Symposium on River Mechanics, International Association for Hydraulic Research, Bangkok, Thailand, January 1973

Registered professional engineer: Ohio

FRED REARDON
Associate Professor of Mechanical Engineering
Mechanical Engineering Department
1966

BS	University of Pennsylvania
MS	University of Pennsylvania
PhD	Princeton University

Fluid mechanics, including aerodynamics, compressible flow and acoustics; combustion, including incineration and propulsion applications; technology and society, also known as social impact of technology or socio-engineering

"Reference Book on Liquid Propellant Rocket Combustion Instability," due out of Government Printing Office any day (with D. T. Harrje)

"Effects of Combustion and Flow on Baffle Damping," *7th JANNAF Combustion Meeting*, CPIA Pub. 204, *1*, February 1971

"The Young Engineering Teacher Views Engineering Education," (part of panel discussion) *Mechanical Engineering*, February 1970

CHRIS S. TOMINE
Assistant Professor of Civil Engineering
Civil Engineering Department
1970

BS	University of California-Berkeley
MS	Oregon State University

Atmospheric pollution, light scattering by aerosols, material science

100%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Civil Engineering	Master's	4	24	5	28	12	34	16	32	12	36	ENROLLMENT
Civil Engineering	Master's	6		5		15		15		10		GRADUATES
Civil Engineering	Master's	4										NON-US NATIONALS

	Master's	
Traineeships	5	SUPPORT
Research projects	4	
Government employer	36	
Industrial employer	3	

Consulting firms	20	EMPLOYMENT (%)
Industry	5	
Federal government	20	
Other government	45	
Further study	10	

Facilities

Air and water quality laboratories are adequately equipped to perform regular analytical work. The Chemistry Department has complete analytical laboratory facilities available adjacent to the air and water quality lab. Adequate computer facilities are available on campus and at other nearby locations. A modern, elaborately equipped technician shop staffed by highly skilled personnel is available.

California State University-San Jose

San Jose, California

Civil Engineering Department
School of Engineering

Environmental Engineering

Dr. Robert G. Spicher, Area Chairman
Environmental Engineering
Civil Engineering Department
California State University
San Jose, CA 95192
(408) 277-2718

February 1974

The graduate program in environmental engineering at California State University-San Jose has two main purposes associated with two broad career objectives. One is to present a terminal degree program for graduate engineers desiring advanced training in environmental engineering. The second major purpose is to provide opportunity for the first year of graduate study for those students whose immediate professional objectives are directed toward continued advanced study beyond the MS. The program is built on a core of courses in water quality control and wastewater treatment. Departmental offerings in industrial wastes, air pollution, and solid wastes provide additional course work in the major. An MS Degree is offered.

Admission Requirements

(a) 2.0/4 in all college work and 2.5/4 in all upper division work.

(b) All students are required to take the Aptitude Test of the GRE.

(c) If a student does not meet the requirements in (a) above, he may be admitted to unclassified status and be required to take additional preparatory courses.

(e) Any engineering discipline from an accredited institution is acceptable as well as chemistry, public health, microbiology, and oceanography.

(f) Make-up courses in fluid mechanics, hydraulic engineering, and introduction to environmental engineering may be required of nonengineers entering the program.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engr. (with spec. in Envir. Engr.)	31S	Optional	No	No	12-18

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 171	Water Quality Control	-	3S	S'74	10
CE 173	Solid Wastes	-	3S	F'73	17
CE 174	Atmospheric Pollution	-	3S	S'74	11
CE 270	Envir. Engr. Phys. Systems	-	3S	F'73	6
CE 271	Envir. Engr. Biol. Systems	-	4S	F'73	9
CE 272B	Envir. Engr. Chem. Systems	-	4S	S'74	11
CE 273	Advanced Envir. Engr. Lab	-	4S	S'74	6
CE 274	Industrial Wastes	-	3S	F'71	8
CE 272A	Envir. Engr. Lab	-	3S	F'73	11
CE 279	Envir. Engr. Seminar	-	1S	S'73	7
CE 254A	Water Resources Engineering I	-	3S	F'73	23
CE 254B	Water Resources Engineering II	-	3S	S'74	8
CE 255	Hydrology	-	3S	S'74	20
Mic 100	Microbiology & Hum. Wel.	-	3S	S'74	-
ML 101	General Oceanography	-	3S	S'74	-
IE 130	Statistics	-	3S	S'74	-
Met 131	Air Pollution Meteorology	-	3S	S'74	-
Chm 175	Physical Chemistry	-	3S	S'74	-

CE 270, 271, 272A, 272B, and one unit of CE 298 (special problems) are required of all students.

Faculty

ROBERT G. SPICHER
Associate Professor
Civil Engineering Department
1965

BSCE	Cornell University	Civil Engineering	1958
MS	University of California-Berkeley	Sanitary Engineering	1959
ScD	Washington University	Environmental & Sanitary Engr.	1963

Industrial wastes, physical-chemical processes, solid wastes, air pollution

80% (teaching)

Registered professional engineer: California

Previous full-time professional experience: 3 yrs. (2 yrs. academic and 1 yr. industry)

Member, AEEP

BRODERICK P. HASKELL, JR.
Associate Professor
Civil Engineering Department
1959

BS	University of California-Berkeley	Civil Engineering	1950
MS	University of California-Berkeley	Sanitary Engineering	1951

Engineering-economic systems, decision analysis

100% (50% teaching, 50% administration)

Previous full-time professional experience: 8 yrs. (1 yr. research and 7 yrs. consulting)

ROBERT A FISHER
Assistant Professor
Civil Engineering Department
1972

BS	Cornell University	Chemical Engineering	1965
ME	Cornell University	Chemical Engineering	1966
MS	San Jose State College	Civil Engineering	1967

Biological and chemical systems, environmental engineering labs

100% (teaching)

Previous full-time professional experience: 2 yrs. (industry)

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Civil Engineering (Envir. Engr.)	Master's	13	1	12	3	15	6	13	6	6	9	ENROLLMENT
Civil Engineering (Envir. Engr.)	Master's	11		6		12		9		5		GRADUATES
Civil Engineering (Envir. Engr.)	Master's	4										NON-US NATIONALS

	Master's	
EPA traineeships	6	SUPPORT
Self-supporting	9	
Consulting	30	EMPLOYMENT (%)
Industry	6	
Federal government	8	
Other government	18	
Academic	3	
Further study	10	
Military	11	
Unknown	14	

University of Cincinnati

Cincinnati, Ohio

Department of Civil and Environmental Engineering
College of Engineering
Environmental Engineering Division

Environmental Engineering

ECPD Accredited--Environmental Engineering

Dr. J. David Eye, Professor
Environmental Engineering
Location 71
University of Cincinnati
Cincinnati, OH 45221
(513) 475-1165 or 3648

May 1973

The graduate program in environmental engineering at the University of Cincinnati is designed to permit students to specialize in water pollution control, air pollution control, and/or solid refuse management or to pursue a general course of study in environmental health engineering and science. The program is coordinated with programs in water resources management and earth sciences offered by the Department, with the program in the Department of Community Planning, and with the occupational health program in the College of Medicine. The MS and PhD Degrees are awarded to persons who successfully complete the minimum requirements for the respective degree. A Master's thesis normally is required and a doctoral dissertation is required.

Each student's program is specifically designed to best meet his needs in terms of his background training and stated professional objectives. Students may enroll on a full-time basis, a part-time basis, or participate in the graduate cooperative program. Most courses are available in both the regular day program and also in the evening college program. A student may start his program at the beginning of the autumn or winter quarters.

The University of Cincinnati is a municipally owned, state assisted institution with a total enrollment in excess of 30,000 students. The University is located in a residential-commercial section of Cincinnati, close to the heart of the city. The new Environmental Protection Agency Research Center is being constructed adjacent to the campus and the Navy Environmental Health Center is located just a few blocks from the campus.

Tuition and fees range from $300-700 per quarter depending on the residence status of the student.

Admission Requirements

(a) An undergraduate GPA of 3.0/4. This requirement may be waived for Master's students.

(b) GRE test is recommended but not required.

(c) Students may be admitted on a provisional basis for one quarter. Financial aid will not be offered to students admitted on a provisional basis until they have demonstrated their ability to successfully pursue graduate level study.

(d) Foreign students must have a TOEFL score of 525 and must take special courses in English during the first year of graduate study.

(e) Students with first degrees in engineering, chemistry, biology, physics, mathematics, economics, administration, geology, or planning are eligible for admission to the program.

(f) Make-up courses are required only when a student cannot meet the prerequisites for a course required as a part of his graduate program.

(g) A strong desire to follow a professional career in environmental control and strong letters of recommendation are needed for admission.

(h) A student must normally acquire a Master's Degree before being admitted for doctoral study.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr	45Q	Yes	No	3Q	12-15
MS--Envir. Engr.	51Q	No	No	3Q	-
PhD--Envir. Engr.	90Q	Yes	Optional	4Q	24-36

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
EnvE 614	Solid Waste	Morand	-	W'73	37
EnvE 619[1]	Environmental Microbiology I	Scarpino	-	A'71	26
EnvE 620[1]	Environmental Microbiology I	Scarpino	-	W'72	26
EnvE 621[1]	Environmental Chemistry I	Kinman	-	A'72	12
EnvE 622[1]	Environmental Chemistry I	Kinman	-	W'73	12
EnvE 631	Environmental Proj.	Morand	-	W'73	4
EnvE 632	Environmental Proj.	Morand	-	W'73	4
EnvE 633	Environmental Proj.	Morand	-	W'73	4
EnvE 641	Environmental Seminar	Staff	-	A'72	45
EnvE 642	Environmental Seminar	Staff	-	W'73	45
EnvE 643	Environmental Seminar	Staff	-	S'73	45
EnvE 645	Environmental Sanitation	Eye	-	A'72	28
EnvE 646	Environmental Microbiology I	Scarpino	-	A'72	16
EnvE 646	Environmental Microbiology I	Scarpino	-	W'73	16
EnvE 647	Environmental Chemistry I	Kinman	-	A'72	14
EnvE 647	Environmental Chemistry I	Kinman	-	W'73	14
EnvE 648	Environmental Engineering Lab	Morand	-	S'73	9
EnvE 651	Water Pollution Control	Eye	-	A'72	38

EnvE 661	Air Pollution Control	Gruber	-	W'73	35
EnvE 661	Air Pollution Control	Gruber	-	S'73	35
EnvE 662	Principles of Air Quality	Pattison	-	A'72	25
EnvE 663	Automotive Air Pollution	Pattison	-	S'73	20
EnvE 664	Air Pollution Management	Pattison	-	S'72	20
EnvE 665	Air Pollution Chemistry	Pattison	-	A'72	18
EnvE 666	Principles of Air Management	Gruber	-	S'73	35
EnvE 718[1]	Solid Waste Analysis	Kinman	-	S'73	9
EnvE 719[1]	Environmental Microbiology II	Scarpino	-	S'72	24
EnvE 720	Environmental Chemistry II	Kinman	-	S'73	5
EnvE 722	Water Pollution Control	Eye	-	S'73	22
EnvE 734	Air Pollution Control Methods	Gruber	-	W'73	20
EnvE 735	Air Pollution Control Methods	Gruber	-	S'73	20
EnvE 736	Field Studies Air Pollution	Gruber	-	S'72	15
EnvE 740	Small Particle Technology	Licht	-	A'72	18
EnvE 741	Particle Laboratory	Pattison	-	A'72	12
EnvE 742	Photochemical Air Pollution	Pattison	-	S'73	2
EnvE 745	Environmental Chemistry II	Kinman	-	S'73	30
EnvE 747	Environmental Microbiology II	Scarpino	-	S'73	22
EnvE 748	Environmental Microbiology III	Scarpino	-	S'73	14
EnvE 768[1]	Water Pollution Control	Morand	-	A	20
EnvE 769[1]	Water Pollution Control	Morand	-	W	20
EnvE 770[1]	Water Pollution Control	Morand	-	S	20
EnvE 754	Design Environmental Control Systems	Eye	-	A'72	30
EnvE 755	Design Environmental Control Systems	Eye	-	W'73	30
EnvE 756	Design Environmental Control Systems	Eye	-	S'73	30
CE 696	Civil Engineering Systems	Lee	-	-	-
CE 690	Stream Hydraulics	Laushey	-	-	-
CE 691	Hydraulic Measurements	Preul	-	-	-
CE 692	Hydraulic Systems & Controls	Preul	-	-	-
CE 693	Hydraulic Engineering	Laushey	-	-	-
CE 694	Hydraulic Engineering	Laushey	-	-	-
CE 794	Ground Water Development	Preul	-	-	-
CE 795	Urban Water Systems	Preul	-	-	-

[1] Indicates evening college course.

Each Master's student must take a course in computer programming and a course in applied statistics for a total of 5-6 credits unless he has had equivalent courses elsewhere. Each student's program is designed from the above list of courses plus courses from other areas of the University. There is no required or fixed program as such, although certain core courses are required for majors in water pollution control and air quality management.

Faculty

J. DAVID EYE
Professor
Environmental Engineering
1956

BS	Virginia Polytechnic Institute	Civil Engineering	1948
MS	Virginia Polytechnic Institute	Sanitary Engineering	1949
ScD	University of Cincinnati	Occupational Health	1966

Water pollution control, design of environmental control systems, public health, occupational health

100% (50% teaching, 20% research, 30% administration)

"Oxidation of Sulfides in Tannery Waste Waters," Journal American Leather Chemists Association, 67, 256, June 1972 (with D. P. Clement)

"Treatment of Wastes from a Sole Leather Tannery," Journal Water Pollution Control Federation, 43, 11, November 1971 (with L. Liu)

"The Use of Flyash in Wastewater Treatment and Sludge Conditioning," Journal Water Pollution Control Federation, 42, 5, Part 2, May 1970 (with T. K. Basu)

"Recovery and Reuse of Tannery Waste Fractions," Environmental Protection Agency, 1972-74, consultant

Registered professional engineer: Virginia

Previous full-time professional experience: 7 yrs. (academic)

Chairman, Planning Subcommittee on Manpower Requirements for Health Care Delivery of the Ohio Health Planning Council
US Member, Commission on Tannery Effluents of the International Union Leather Chemists Societies
Consultant, US Navy Environmental Health Center (1966-date)
Consultant, Tanners' Council of America (1965-date)

PASQUALE V. SCARPINO
Professor
Civil and Environmental Engineering
1963

BS	Utica College	Microbiology	1955
MS	Rutgers University	Microbiology	1958
PhD	Rutgers University	Microbiology	1961

Aquatic microbiology, control of viruses in water

100% (50% teaching, 50% research)

"A Comparative Study of the Inactivation of Viruses in Water by Chlorine," Water Research, 6, 715, 1972 (et al.)

"Bacterial and Viral Analysis of Water and Wastewater," Water and Water Pollution Handbook, Vol. II, Marcel Dekker, 1971

"The Uptake and Distribution of Manganese-54 by Chara braunii in a Freshwater System," Journal Environmental Health, 32, 312, 1969

"A Comparative Study of the Inactivation of Viruses in Wastewater by Chlorine and Chlorine Compounds," Environmental Protection Agency, 1971-73

Previous full-time professional experience: 2 yrs. (academic)

American Society for Microbiology: Member, Committee of Education (1964-72); Member, Subcommittee on International Educational Assistance (1965-66); Chairman, Ad Hoc Committee on Revision of "Microbiology in Introductory Biology," a special issue of American Biology Teacher Journal (1967-68); Chairman, Committee on Education (1970-72); Chairman, Committee on the Role of Microbiology in Education for Other Disciplines (1972-73)
Member, Ohio Branch, American Society of Microbiology; Chairman, Education Committee (1966-date)
Member, Environmental Task Force, City of Cincinnati (1972-date); Chairman, Water Subcommittee (1972)

LOUIS M. LAUSHEY
Head
Civil and Environmental Engineering
1957

BS	Pennsylvania State	Civil Engineering	1942
MS	Carnegie Institute	Civil Engineering	1947
ScD	Carnegie Institute	Civil Engineering	1951

Hydraulics, systems

20% (5% teaching, 3% research, 12% administration)

"Backwater Storage Changes During Unsteady Flow," Proceedings of the 11th International Association for Hydraulic Research Congress, Leningrad, 3.13: 1-8, 1965

"Velocities of Culvert Jets for Incipient Erosion," Proceedings 12th Congress of the International Association for Hydraulic Research, 3: 1-8, 1967

"Darcy's Law During Unsteady Flow," 14th General Assembly of the International Union of Geodesy and Geophysics, Bern, Switzerland, 1967

Registered professional engineer: Vermont

Previous full-time professional experience: 8 yrs. (6 yrs. academic and 2 yrs. military)

Fellow, American Society of Civil Engineers: President, Cincinnati Section (1965-66); President, Vermont Section (1956); Vice President, Maine Section (1957); Chairman, Alfred Nobel Prize, National Committee (1957); Chairman, District 9 Council (1971-72); Vice President, Ohio Council of Local Sections (1971-72)
American Society for Engineering Education: Chairman, Ohio Section (1964-65)
Member, Society American Military Engineers: President, Cincinnati Post (1961-62)
Member, American Geophysical Union
Member, International Association for Hydraulic Research

CHARLES W. GRUBER
Associate Professor
Civil and Environmental Engineering
1969

BS	University of Cincinnati	Mechanical Engineering	1932

Air pollution control methods, air pollution control administration and legislation, source measurement

100% (70% teaching, 20% research, 10% administration)

"Source Inspection and Survey," Chapter 30, Vol. II (2nd ed.), Air Pollution: A Comprehensive Treatise, Academic Press, 1968 (also 1st ed. 1962)

"Atmospheric Emissions from Coal Firing--An Inventory Guide," PHS Publication No. 999, AP 24, April 1966 (with W. S. Smith)

"Odor Pollution from the Control Officials' Viewpoint," American Society for Testing and Materials Symposium on Odor, Chicago, June 1954

"Recommended Standard Method for Measuring Wind-Blown Nuisance Particles," Journal Air Pollution Control Association, 20, 3, March 1970 (with W. C. Pritchard and C. E. Schumann)

"Method of Reducing Air Pollution Caused by Combustion (Domestic and Commercial)," European Conference on Air Pollution Control, Council of European States, Stausborg, France, June-July 1964

Registered professional engineer: Ohio

Previous full-time professional experience: 30 yrs. (city government)

Member, Air Pollution Control Association; President (1950-51); Board of Directors (1950-52, 1961-62); Chairman, Control Technology Division (1970-73); and Frank A. Chambers Award (1964)
Member, American Society of Mechanical Engineers; Member, Executive Committee, Division of Air Pollution Control (1972-73)
Adjunct Faculty Lecturer, Environmental Protection Agency, Division of Manpower Development, Air Training Institute
Consultant, PEDCO Environmental Specialist Inc., Preparation Field Surveillance Guide (1972-73)

WILLIAM LICHT
Professor
Chemical Engineering
1939

ChE	University of Cincinnati	Chemical Engineering	1937
MS	University of Cincinnati	Chemical Engineering	1939
PhD	University of Cincinnati	Chemical Engineering	1950

Air pollution control, collection of particulate matter, design of systems, fluidization, heat and mass transfer in fluid-solid systems

65% (40% teaching, 25% research)

"The Control of Sulfur Oxide," American Institute of Chemical Engineers Advanced Seminar Series, 1972

"The Movement of Aerosol Particles," Journal Society of Cosmetic Chemistry, 23, 657-678, September 1972

"The Collection Efficiency of Cyclone Type Particle Collectors--A New Theoretical Approach," American Institute of Chemical Engineers Symposium Series No. 126, 68, 196-206, 1972 (with D. Leith)

"A Course in Design of Air Pollution Control Systems," Chemical Engineering Education, 176-178, Fall 1970

Registered professional engineer: Ohio

Member, Air Pollution Board, City of Cincinnati (1967-72); Chairman (1970-71)
Member, Air Technical Committee, Environmental Division, American Institute of Chemical Engineers
Consultant, various industrial organizations

HERBERT C. PREUL
Associate Professor
Civil and Environmental Engineering
1964

BS	University of Iowa	Civil Engineering	1950
MS	University of Minnesota	Hydraulics	1955
PhD	University of Minnesota	Sanitary Engineering	1964

Water resources, water pollution control, hydraulics, hydrology

20% (10% teaching, 10% research)

"University of Cincinnati Urban Runoff Model," Hydraulics Division, American Society of Civil Engineers, October 1972 (with C. Papadakis)

"Underground Pollution Analysis and Control," accepted for publication in Water Research, 1972

"Groundwater Pollution by Nitrogen Compounds in Israel," Proceedings of 6th International Conference, Water Pollution Research, June 1972

"Urban Runoff Characteristics," Environmental Protection Agency, 1971-73, principal investigator

Registered professional engineer: Ohio, Iowa and Minnesota

Previous full-time professional experience: 8 yrs. (government)

Director, Engineering Society of Cincinnati (1971-74)
Member, American Water Resources Association; President, Ohio Section (1971-72)
Chairman and Director, International Water Resources Association, Technical Program (1972-73)
Consultant, World Health Organization (1972-73)

RILEY N. KINMAN
Associate Professor
Civil and Environmental Engineering
1968

BS	University of Kentucky	Civil Engineering	1959
MS	University of Cincinnati	Sanitary Engineering	1962
PhD	University of Florida	Sanitary Chemistry	1965

Water chemistry, disinfection of water and waste, solid refuse

100% (30% teaching, 70% research)

"Review of the 1971 Disinfection Literature," Journal Water Pollution Control Federation, 44, 972, June 1972 (with H. A. Faber)

"Ozone in Water Disinfection," Chapter 7 of Ozone in Water and Wastewater Treatment, Ann Arbor Science Publishers, Inc., 1972

"The Use of Ozone in Water Disinfection," Proceedings Sanitary Engineering Institute, University of Wisconsin, March 1971

Registered professional engineer: Ohio and Kentucky

Previous full-time professional experience: 5 yrs. (government)

Member, Federal Water Quality Association
Member, Research Committee, Water Pollution Control Federation
Chairman, Board of Directors, The Water and Wastewater Technical School, Neosho, Missouri

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JAMES M. MORAND
Associate Professor
Civil and Environmental Engineering
1964

BS	University of Cincinnati	Civil Engineering	1960
MS	University of Cincinnati	Sanitary Engineering	1961
PhD	University of Wisconsin	Sanitary Engineering	1964

Water and wastewater treatment, solid refuse

100% (80% teaching, 10% research, 10% administration)

"Tertiary Treatment of Combined Wastewater with Granular Activated Carbon," Water and Wastes Engineering, 58-60, September 1970 (with R. H. Zanitsch)

"Floc Sizing Techniques," Applied Microbiology, 15, 1, 125-134, January 1967 (with J. A. Mueller and W. C. Boyle)

"A Field Study of the Extended Aeration Process," paper presented at 21st Annual Industrial Waste Conference at Purdue University, May 3, 1966. Engineering Bulletin, Purdue University, I, 2, Engineering Extension Series No. 121, 424-439 (with J. J. Westrick and J. D. Eye)

Registered professional engineer: Ohio

Member, American Society of Civil Engineers
Member, American Water Works Association
Member, American Society for Engineering Education

JOHN N. PATTISON
Research Professor
Environmental Engineering
1967

BSChem	West Virginia University	-	1941
PhD	Purdue University	-	1948

Air pollution control methods, air pollution control legislation

100% (70% teaching, 20% research, 10% administration)

"Analysis of Aliphatic Fraction of Air Particulate Matter," Environmental Science and Technology, 6, 549-555, 1972 (with T. R. Hauser)

"New Federal Driving Cycle for Emission Tests," Journal Air Pollution Control Association, 21, 88, 1971

"Pros and Cons for Lead in Gasoline," Journal Air Pollution Control Association, 21, 354, 1971

"Control of Used Cars by Inspection and Maintenance," Journal Air Pollution Control Association, 21, 570, 1971

Previous full-time professional experience: 26 yrs. (23 yrs. research and 3 yrs. consulting)

Member, Air Pollution Control Association; Vehicular Exhaust Committee TS-1.1; Chairman, Education and Training Committee S-11
Member, American Chemical Society; Chairman, Columbus Section (1956)
Member, Society of Automotive Engineers
Chairman, Panels 2 National Academy of Sciences, Committee on Motor Vehicle Emissions
Member, Vehicle Emissions Committee, International Standards Organization

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JOHN C. H. LEE, JR.
Adjunct Associate Professor
Civil and Environmental Engineering
1970

Graduate	Command & General Staff College & Air University	-	-
BS Mil Sci	US Military Academy	-	1941
MS	University of Iowa	-	1948

Hydraulics, systems

20% (10% teaching, 10% research)

"Computing Post-Graduate Requirements for the Army," 1964

"Let's Put Wings on the Infantry," Saturday Evening Post, May 1952

Development of Water Resources in Appalachia, US Corps of Engineers, Office of Appalachia Studies, Cincinnati, 1969 (25 vols.)

"An Optimum Method of Cost Allocation and Cost Sharing Applicable to Multiobjective Water Resources Planning and Related Comments," paper presented to the Federal Water Resources Council, 1972, 44 p (mimeo) (with C. A. Berry)

"Capturing the Potential of Water Resources Investments," paper presented to the National Water Commission, 1973, 16 pp (mimeo)

Registered professional engineer: District of Columbia

Previous full-time professional experience: 9 yrs. (7 yrs. government and 2 yrs. consulting)

Member, American Society of Civil Engineers
Member, Society of American Military Engineers; President, Frankfurt, Germany Chapter (1963)
Member, American Water Resources Association
Member, US Committee on Large Dams (USCOLD)

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	14	16	23	18	37	25	33	30	39	28	ENROLLMENT
	Doctoral	4	1	4	2	4	4	2	5	3	5	
Environmental Engineering	Master's	13		13		22		32		-		GRADUATES
	Doctoral	0		3		3		3		-		
Environmental Engineering	Master's	8		NON-US NATIONALS								
	Doctoral	2										

	Master's	Doctoral	
EPA traineeship	23	1	SUPPORT
PHS traineeship	8	0	
Teaching assistantship	0	2	
University scholarship	3	0	
Other	5	0	
Federal government	21	33	EMPLOYMENT (%)
Other government	28	33	
Consulting	20	0	
Further study	10	0	
Military	1	0	
Unknown	2	0	
Industry	16	12	
Academic	2	22	

Facilities

The laboratory facilities (some 12,000 sq ft) serving the environmental engineering program are outstanding in every respect. Individual office-laboratory units and required equipment for thesis and dissertation research are made available to all students during the period of active research.

Clemson University

Clemson, South Carolina

Environmental Systems Engineering
College of Engineering

Environmental Systems Engineering
Water Resources Engineering

ECPD Accredited--Environmental Systems Engineering

Dr. John H. Austin, Head
Environmental Systems Engineering
401 Rhodes Research Center
Clemson University
Clemson, SC 29631
(803) 656-3276

Dr. Benjamin C. Dysart III, Director
Water Resources Engineering
401 Rhodes Research Center
Clemson University
Clemson, SC 29631
(803) 656-3276

March 1974

The Environmental Systems Engineering Department emphasizes the application of the basic principles of the sciences and systems engineering to the design, operation, planning or management of man-made environmental control systems or to the analysis and management of natural systems. The department emphasizes interdisciplinary studies and has strong ties with other engineering and science departments in the University. A student can specialize in water and wastewater treatment systems, natural systems, environmental science or planning and management. Students who specialize in the planning and management area are encouraged to meet the requirements of the water resources engineering program area which is directed by a faculty member of the ESE Department. The degrees of MS, MEngr, and PhD in environmental systems engineering are offered.

Clemson University is South Carolina's land-grant institution offering 49 undergraduate and 47 graduate programs in nine academic areas. An on-campus enrollment of 10,000 includes 1600 graduate students. Since 1968 when the ESE Department was formally organized, the graduate program faculty have attracted nearly $1.5 million in external funding, including one-half million in training grant monies, from federal and state agencies and private industry. Tuition and fees for full-time graduate students average $700 an academic year. On-campus room and board ranges from $400-500 a semester. Off-campus apartments are priced from $90-200 a month.

Clemson University, in the foothills of the Blue Ridge Mountains, is located on the shore of Lake Hartwell, a large multi-purpose reservoir. Clemson, a community of 10,000, is a typical small college town. Greenville, population 125,000 is 30 miles away, while Atlanta, Georgia and Charlotte, North Carolina are two and one-half hours from Clemson by car. Although Clemson residents enjoy mild winters, traditional winter sports are available both in the Blue Ridge Mountains and in the Great Smokey Mountains (100 miles away).

Admission Requirements

(a) 2.25/4 for MEngr; 2.5/4 for MS; and 3.0/4 on Master's work or 3.0/4 overall for PhD.

(b) GRE of 1000 for MS and PhD is required with 400 minimum verbal and 600 quantitative. Advanced GRE not required.

(c) Admission to Master's program is possible for GPR down to 2.0/4 for MEngr and 2.25/4 for MS provided strong recommendations are submitted. Students must obtain a 3.0/4 in first semester to obtain full graduate standing.

(d) Foreign students must score not less than 50 in any of 5 categories and a total of 555 on the TOEFL examination.

(e) In addition to students with a BS degree in any branch of engineering, students from chemistry, physics, biology, mathematics, and economics with a mathematical background through differential equations may be admitted with appropriate engineering prerequisites.

(f) During the first semester, nonengineers must take for credit a course in ordinary differential equations and introductory fluid mechanics.

(g) Applicants for the PhD must have letters from at least two professors acquainted with their academic work in the area in which they plan graduate study.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Systems Engr.	30S	Optional	No	2S	12
MS--Water Resources Engr.	30S	Optional	No	2S	12
MEngr--Envir. Systems Engr.	30S	Optional	No	2S	12
MEngr--Water Resources Engr.	30S	Optional	No	2S	12
PhD--Envir. Systems Engr.	-	Yes	No	2S	36

Course Work

Degree	Title	Instructor	Credits	Last Pres.	Enrollment
ESE 601[4]	Environmental Engineering	Rich	3S	S'74	23
ESE 602[2,3,4]	Water & WW Treatment Systems	Keinath	3S	S'74	16
ESE 643[1,2,4]	Envir. Engr. Chemistry	Iracki	2S	F'73	15
ESE 644[1,2]	Envir. Engr. Chemistry Lab.	Iracki	2S	F'73	8
ESE 701	Special Problems	Staff	1-4S	New'73	-
ESE 802(843)[1,2]	Unit Operations of San. Engr.	Keinath	4S	F'73	17
ESE 803(833)[1,2]	Unit Operations Lab.	Keinath	1S	F'73	13
ESE 804(842)[1]	Sanitary Engineering Processes	Andrews	4S	S'74	10
ESE 805(832)[1]	Unit Processes Lab.	Andrews	1S	S'74	10
ESE 806(852)[1]	Water & WW Treatment Systems	Dysart	2S	Su'73	17
ESE 846[1,2,3,4]	Pollution of the Aquatic Environment	Abernathy	3S	S'74	29
ESE 847	Pollution of the Aquatic Environment	Abernathy	1S	S'74	6
ESE 848	Envir. Engr. Chemistry	Iracki	2S	S'73	8
ESE 849	Envir. Engr. Chemistry Lab. II	Staff	2S	S'73	3
ESE 861[1,2,3,4]	ESE Seminar	Dysart	1S	S'74	23

ESE 862[1,2,3,4]	Environmental Quality Case Study	Dysart	1S	S'74	25
ESE 881	Special Problems	Staff	1-4S	S'74	4
ESE 883[4]	Selected Topics in Envir. Engr.	Staff	1-4S	S'74	1
ESE 884	Selected Topics in Envir. Engr.	Staff	1-4S	S'74	10
WRE 650	Water Resources Engineering	Dysart	3S	F'73	10
WRE 660	Physical Oceanography	Edge	3S	F'72	11
WRE 661	Oceanography Engineering	Edge	3S	F'73	7
WRE 881	Climatology	Landers	3S	F'69	12
WRE 822	Water Movement in Soils	Ligon	3S	S'74	7
WRE 865[3]	Hydrology I	Law	3S	F'73	13
WRE 866	Hydrology II	Law	3S	S'74	8
WRE 870[2,3]	Stream & Estuarine Analysis	Edge	3S	F'73	9
WRE 871	Coastal Hydromatics	Edge	3S	New'73	-
WRE 872	Marine Pollution Control	Edge	2S	S'73	8
WRE 875[3]	River Basin Planning	Dysart	2S	S'74	17
WRE 876[3]	Water Resources Systems	Dysart	2S	Su'73	7
WRE 881	Special Problems in Water Res. Engr.	Staff	1-4S	S'74	5
WRE 883	Selected Topics in Water Res. Engr.	Dysart	1-4S	S'73	5
E&CE 850	Computation & Simulation	Wolla	3S	F'73	5
SE 803	Engr. Applications of Optimization	Tolins	3S	S'74	4
ChE 653	Process Dynamics	Beard	3S	S'73	3
ChE 662	Air Resources Engineering	Alley	3S	S'74	10
FM 816	Flow in Open Channels	Zielinski	3S	S'74	8
AgEc 804	Water Resource Policies	Stepp	3S	F'73	7
AgEc 805	Coastal Zone Management	Hite	3S	S'74	8
CRP 611	Intro. to City & Regional Planning	Falk	3S	F'73	30
Geol 600	Environmental Geology	Hatcher	3S	F'73	35
RPA 705	Recreational Aspects of Water Res.	Gahan	3S	F'73	7

[1] Water Treatment Systems Core

[2] Natural Systems Core

[3] Planning and Management Core (Water Resources Engineering Core)

[4] Environmental Science Core

Faculty

JOHN H. AUSTIN
Professor and Head
Environmental Systems Engineering
1969

BCE	Syracuse University	Civil Engineering	1951
SM	Massachusetts Institute of Technology	Sanitary Engineering	1953
PhD	University of California-Berkeley	Sanitary Engineering	1963

Environmental education systems

100% (25% teaching, 25% research, 50% administration)

"A Role of Instructional Technology in the Solution to Environmental Pollution," Tutorial Proceedings, Institute of Environmental Sciences, pp. 73-84, 1972 (with R. L. Reynolds)

"Systems Approach to Licensing," Journal American Water Works Association, 63, 12, pp. 743-146, 1971 (with A. B. Redekopp)

"Training the Environmental Technician," American Journal of Public Health, 60, pp. 2314-2320, 1970 (with W. M. McLellon and J. C. Dyer)

"Criteria for the Establishment and Maintenance of Two Year Post High School Wastewater Tecnnology Training Programs (CEWT)," Environmental Protection Agency, 5/71-date, principal investigator

Registered professional engineer: New York and South Carolina

Previous full-time professional experience: 11 yrs. (5 yrs. government and 6 yrs. academic)

Member, AEEP
Diplomate, AAEE
President, Association for Environmental Engineering Professors (1972-73)
Board of Directors, American Association of Professors in Sanitary Engineering (1970-72)
Chairman, Environmental Health Task Force of Comprehensive Health Planning Committee, State of South Carolina (1971-date)
Ad Hoc Advisory Committee, Sacramento State College's Operator Training Grant, Environmental Protection Agency (1971-date)

BENJAMIN C. DYSART III
Associate Professor of Environmental Systems Engineering and Director of Water Resources Engineering
Environmental Systems Engineering
1968

BE	Vanderbilt University	Civil Engineering	1961
MS	Vanderbilt University	Sanitary Engineering	1964
PhD	Georgia Institute of Technology	Water Resources Engineering	1969

Environmental aspects of power generation, water resources planning and management, water quality modeling, environmental impact, and public participation

100% (40% teaching, 40% research, 20% administration)

"Water Quality Planning in the Presence of Interacting Pollutants," Journal Water Pollution Control Federation, 42, 8, 1970

"Control of Water Quality in a Complex Natural System," Institute of Electrical and Electronics Engineers, Inc. Transactions on Systems Science and Cybernetics, SSC-6, 4, 1970

"Alternate Policies for River Basin Water Quality Management," Proceedings, 14th Congress of the International Association for Hydraulic Research, 5, Water Resources Systems Seminar No. 4, Paris, France, 1971

"Modeling Techniques for Siting Large Thermal Power Plants on Industrialized Estuaries," Proceedings, International Symposium on Modeling Techniques in Water Resources Systems, Ottawa, Canada, 1972 (with B. L. Edge)

"Stochastic Modeling of the Interactions between Treatment Systems and Receiving Waters," Mathematical Modeling in Environmental Engineering, Proceedings of 8th Annual AEEP Workshop, Nassau, Bahama Islands, 1972

"Development of Regional Management Policies Using Advanced Water Resources Planning Techniques," Office of Water Resources Research, 1969-72, principal investigator

"Siting Power Plants on Estuaries Considering Interaction of Thermal Pollution with Other Wastes," Office of Water Resources Research, 7/71-12/73, co-principal investigator

"Multi-Objective Water Resources Planning: Methodology to Achieve Compatibility between Environmental Amenities and Economic Development," South Carolina Water Resources Commission, 7/73-6/74, co-principal investigator

Previous full-time professional experience: 3 yrs. (industry)

Member, AEEP
Member and Past Chairman, Water Pollution Control Planning Committee, Environmental Engineering Division, American Society of Civil Engineers (1972-date)
Member of the Directorate, Water Resources Research Institute, Clemson University (1968-date)
Site visitor, National Science Foundation (1973)
Member, Board of Directors, National Wildlife Federation (1974-77)

A. RAY ABERNATHY
Professor
Environmental Systems Engineering
1962

AB	Lenoir Rhyne College	Chemistry	1953
MSPH	University of North Carolina-Chapel Hill	Sanitary Chemistry--Biology	1959
PhD	University of North Carolina-Chapel Hill	Environmental Science	1963

Limnology and water pollution control, environmental surveillance, sanitary chemistry and biology, environmental health

100% (50% teaching, 50% research)

"Significance of Trace Elements and Organic Compounds in Water Supplies," Journal Southeast Section American Water Works Association, May 1970

"Textile Waste Treatment Today and Tomorrow," Water-1970, Chemical Engineering Progress Symposium Series, 67, 471, 1970 (with J. J. Porter and W. F. Nolan)

"Measurement of Microbial Degradation of Sulfonate Lignin," Proceedings, 19th Industrial Waste Conference, Purdue University, Ext. Ser. 117, 602 (1964)

"Mercury Concentrations in Fish from Lakes Keowee and Jocassee," Duke Power Company, 9/73-9/74, principal investigator

"Color Measurement Methods for Surface Waters Receiving Colored Wastes," Clemson University Water Resources Research Institute, 10/72-6/74, principal investigator

"Water Quality Predictions Based on Limnological Parameters," Clemson University Water Resources Research Institute, 8/68-6/71, principal investigator

Member, AEEP
Member, Water Pollution Control Federation; Member, Board of Control (1973-76); Chairman, South Carolina Member Association (1972)
Member, American Water Works Association
Member, American Society of Limnology and Oceanography

JOHN F. ANDREWS
Professor
Environmental Systems Engineering
1963

BS	University of Arkansas	Civil Engineering	1951
MS	University of Arkansas	Civil Engineering	1953
PhD	University of California	Sanitary Engineering	1964

Biological processes for wastewater treatment, dynamic models of biological processes for wastewater treatment, control systems for wastewater treatment, computer control of wastewater treatment plants

100% (50% teaching, 50% research)

"Kinetic Models of Biological Waste Treatment Processes," in Biological Waste Treatment (R. P. Canale, ed.), John Wiley and Sons, New York, 1971

"Dynamic Modeling and Simulation of the Anaerobic Digestion Process," in Anaerobic Biological Treatment Processes, Advances in Chemistry Series No. 105, American Chemical Society, Washington, 1971 (with S. Graef)

"Control Systems for Wastewater Treatment Plants," Water Research, 6, 575, 1972

"An Aerobic Thermophilic Process for Biological Waste Treatment--Simulation Studies," Journal Water Pollution Control Federation, 41, R127, 1969 (with K. Kambhu)

"Dynamics and Control of a Multi-Stage Biological Process," Proceedings, 4th International Fermentation Symposium, 55, Kyoto, Japan, 1972

"Training Grant on Operation and Management of Treatment Plants," Environmental Protection Agency, 1970-date, principal investigator

"Thermophilic Aerobic Process for Waste Treatment," US Public Health Service, 1967-70, principal investigator

"Management System for Identification and Correction of Operation and Maintenance Deficiencies in Wastewater Treatment Plants," South Carolina Pollution Control Authority, 1973- , principal investigator

Registered professional engineer: South Carolina and Arkansas

Previous full-time professional experience: 8 yrs. (academic)

Member, AEEP
Diplomate, AAEE
Vice Chairman, International Association for Water Pollution Research Workshop on Design-Operation Interactions for Large Wastewater Treatment Plants, Vienna, Austria (1971)
Member, Pollution Control Authority, South Carolina (1971-73)
Sabbatical leave, Water Pollution Research Laboratory, Stevenage, England (1970)
Board of Directors, American Association of Professors in Sanitary Engineering (1967-70)
Program Chairman, International Association for Water Pollution Research Workshop on Instrumentation, Control and Automation of Wastewater Treatment Systems, London, England (1973)

EDWIN S. IRACKI
Assistant Professor
Environmental Systems Engineering
1972

BS	King's College	Chemistry	1968
MS	University of Illinois	Chemistry	1970
PhD	University of Illinois	Analytical Chemistry	1972

Environmental chemistry, application of online computers to laboratory automation

100% (65% teaching, 35% research)

"Triac Switching Circuitry for Eliminating Interferring Transients in Digital Logic Automated Systems," Analytical Chemistry, 44, 1924, 1972 (with M. B. Denton and H. V. Malmstadt)

"Ratemeter Interface for a Minicomputer-Controlled Reaction-Rate Instrument," Analytical Chemistry, 45, 1766, 1973 (with H. V. Malmstadt)

"A Computer-Controlled Spectrophotometric System for Chemical Rate Methods," American Laboratory, 6 (2), 56, 1974 (with H. V. Malmstadt)

"Utilization of Correlation Analysis in Computer Assisted Reaction-Rate Measurements," Paper #204, Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, March 1974 (with D. Park)

"A Spectrophotometric Reaction-Rate Method for Fluoride," Analytical Chemistry (in press) (with H. V. Malmstadt)

Member, American Chemical Society
Member, Society of Applied Spectroscopy
Member, Optical Society of America

THOMAS M. KEINATH
Associate Professor
Environmental Systems Engineering
1969

BSE	University of Michigan	Civil Engineering	1963
MSE	University of Michigan	Sanitary Engineering	1964
PhD	University of Michigan	Water Resources Engineering	1968

Physicochemical methods of water and wastewater treatment, chemistry of natural waters and environmental control

100% (50% teaching, 50% research)

"Reclamation of Textile Printing Wastewaters for Direct Recycle," Proceedings, 27th Industrial Waste Conference, 1972 (with W. M. Kachel)

"Modeling and Simulation of the Performance of Adsorption Contractors," Proceedings of the 8th Annual AEEP Workshop on Mathematical Modeling in Environmental Engineering, 1973

"Dynamic Model for Clarification and Thickening of Activated Sludge," American Institute of Chemical Engineers Symposium Series Water, 1973 (with K. D. Tracy)

"Competitive Adsorption from Heterogeneous Aqueous Solutions onto Activated Carbon," American Chemical Society Symposium Series, 1973 (with R. P. Carnahan)

"Ecosystem Simulation as a Method of Teaching Aquatic Chemistry," Water, 1973 (with L. G. Rich)

"Mathematical Modeling of Heterogeneous Sorption in Continuous Contactors for Wastewater Decontamination," US Army Research and Development Command, 5/71-8/74, principal investigator

"Development of Process Technology for the Treatment of Textile Finishing Wastewaters," J. P. Stevens and Company, Inc., 9/70-6/74, principal investigator

"Reclamation of Polyvinyl Alcohol from Textile Desizing Wastewaters," E. I. du Pont de Nemours and Company, 1/72-5/74, principal investigator

Registered professional engineer: EIT, Michigan

Previous full-time professional experience: 1 1/2 yrs. (research)

Member, AEEP
Co-Chairman, 8th Annual AEEP Workshop on Mathematical Modeling in Environmental Engineering, Bahama Islands (1972)
Chairman, Research Committee, Association of Environmental Engineering Professors (1973-date)
Co-Chairman, American Chemical Society Symposium on Kinetics in Waste Treatment, Chicago, Illinois (August 1973)
Associate Chairman, Ad Hoc Coordinating Committee for the Preparation of a Unit Operations and Processes Laboratory Manual, American Association of Professors in Sanitary Engineering (1970-date)
Contributing Editor, Sanitary Engineering Division Newsletter, American Society of Civil Engineers (1971-date)

LINVIL G. RICH
Professor
Environmental Systems Engineering
1961

BS	Virginia Polytechnic Institute	Civil Engineering	1947
MS	Virginia Polytechnic Institute	Sanitary Engineering	1948
PhD	Virginia Polytechnic Institute	Biochemistry	1951

Aquatic ecosystems, unit operations and processes

100% (75% teaching, 25% research)

Environmental Systems Engineering, McGraw-Hill, 1973

Unit Operations of Sanitary Engineering, John Wiley and Sons, 1961

Unit Processes of Sanitary Engineering, John Wiley and Sons, 1963

Registered professional engineer: Virginia, West Virginia, Illinois, and South Carolina

Previous full-time professional experience: 1 yr. (government)

Member, AEEP
Diplomate, AAEE
Consultant, US Environmental Protection Agency, Training Grants Program (1963-date)
Consultant, US Department of the Army, Mobility Equipment Command (1972-date)
Member, South Carolina Advisory Committee for Science and Technology (1974-date)
Chairman, Education Committee, Environmental Engineering Intersociety Board (1966-71)

BILLY L. EDGE
Associate Professor
Civil Engineering Department
PhD Georgia Institute of Technology Civil Engineering 1969
Marine resource management and policy, environmental-economic interactions
75%
Member, AEEP

FORREST C. ALLEY
Professor
Chemical Engineering Department
PhD University of North Carolina-Chapel Hill Environmental Engineering 1962
Air pollution control processes
75%

JAMES A. CHISMAN
Associate Professor
Electrical and Computer Engineering
PhD University of Iowa Management Engineering 1963
Operations research in production control, simulation modeling in public systems
25%

JAMES C. HITE
Associate Professor
Agricultural Economics, College of Agricultural Sciences
PhD Clemson University Agricultural Economics 1966
Marine resource management and policy, environmental-economic interactions
50%

JAMES M. STEPP
Alumni Professor
Agricultural Economics, College of Agricultural Sciences
PhD University of Virginia Economics 1940
Water resources policy, economics of industrial wastewater management
25%

CLYDE L. BARTH
Associate Professor
Agricultural Engineering
PhD University of Wisconsin Sanitary Engineering 1971
Agricultural waste management
50%

WALTER E. CASTRO
Professor
Mechanical Engineering
PhD University of West Virginia Theoretical & Applied Mechanics 1966
Fluid mechanics
10%

PAUL B. ZIELINSKI
Associate Professor
Mechanical Engineering
PhD University of Wisconsin Fluid Mechanics & Hydraulics 1965
Fluid mechanics, hydraulics
25%

ROBERT D. HATCHER, JR.
Associate Professor
Geology, College of Physical, Mathematical and Biological Sciences
PhD University of Tennessee Structural Geology 1965
Regional and global tetonics, environmental geology
30%

ALBERT G. LAW
Associate Professor
Mechanical Engineering
PhD University of Wisconsin Civil Engineering 1965
Statistical hydrology, surface water hydrology
20%

LAWRENCE W. GAHAN
Associate Professor
Recreation and Park Administration, College of Forest and Recreation Resources
PhD University of Illinois Recreation & Park Administration 1970
Recreational aspects of water resource development, water recreation behavior patterns
20%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Systems Engineering	Master's	9	0	19	1	23	1	26	2	28	1	ENROLLMENT
	Doctoral	5	0	6	0	9	0	12	0	12	0	
Water Resources Engineering	Master's	6	0	4	0	10	0	10	0	12	0	
	Doctoral	1	0	1	0	1	0	0	0	1	0	
Environmental Systems Engineering	Master's	5		4		9		14		19		GRADUATES
	Doctoral	1		1		1		4		5		
Water Resources Engineering	Master's	3		3		2		5		5		
	Doctoral	0		0		0		0		1		
Environmental Systems Engineering	Master's	1										NON-US NATIONALS
	Doctoral	0										
Water Resources Engineering	Master's	2										
	Doctoral	0										

	ESE		WRE		
	Master's	Doctoral	Master's	Doctoral	
EPA traineeship	8	0	0	0	SUPPORT
Research assistantship	0	0	2	0	
Teaching assistantship	0	0	1	0	
Graduate assistantship	3	5	0	0	
Graduate assistantship with EPA support	5	0	6	0	
Tuition and fees	1	0	0	0	
Foundation support	0	1	0	0	
Government employer	2	0	1	0	
Industrial employer	1	0	1	0	
Self	2	0	1	0	
Other	1	0	1	0	
Consulting	26	30	30	100	EMPLOYMENT (%)
Industry	13	20	40	0	
Federal government	13	0	15	0	
Other government	24	10	15	0	
Academic	0	20	0	0	
Further study	4	0	0	0	
Military	20	20	0	0	

Facilities

Since 1970 the Environmental Systems Engineering Department has been housed in the new Rhodes Engineering Research Center. Analog, hybrid, and small digital computer facilities are available as well as a data acquisition system for continuous collection of data from experimental systems and instruments. A remote terminal is provided for access to the University computer center. The laboratories are designed to permit the construction of bench scale and small pilot scale units. A two-story laboratory is available for operations and processes requiring extra height. The center has four environmental chambers and such sophisticated instrumentation as spectrophotometers, atomic absorption units, and minicomputers. The laboratories are equipped with biological reactors and physical/chemical process units.

University of Colorado

Boulder, Colorado

Department of Civil and Environmental Engineering
College of Engineering

Water Resources and Sanitary Engineering

ECPD Accredited

Dr. Leonard G. Tulin, Chairman
Department of Civil and Environmental Engineering
Engineering Center OT 4-34
University of Colorado
Boulder, CO 80302
(303) 443-2211 x7315

April 1973

The emphasis of this program is on a combined offering of water resources and sanitary engineering studies. Core courses include: water and waste analysis, theory and design of treatment facilities, hydrology, and water resources planning and development. The remainder of the program can be tailored to the students' interests and may include such subjects as water resources law and economics, hydraulic design, stream pollution analysis, process design, public health engineering, and municipal design. Close coordination with the Chemical Engineering Department also allows the student to work in the areas of industrial waste management and air pollution control.

Admission Requirements

(a) 2.75/4 overall; 3.0/4 upper division.

(b) The GRE is advised but not required.

(c) Provisional admission is possible and the decision is based upon individual consideration.

(d) TOEFL is required for admission of foreign students.

(e) Undergraduate discipline areas admissible without extensive prerequisites include: civil engineering, chemical engineering; other engineering areas, chemistry, and microbiology on the basis of individual consideration.

(f) Make-up courses or prerequisites required of nonengineers entering the program are based upon individual considerations.

Degree Requirements

Degree	Credits	Language	Thesis	Residence	Time (mo.)
MS	[a]	No	Optional	9 mo.	9-12
MSE	[a]	No	Optional	9 mo.	9-12
PhD	60S[b]	1	Yes	27 mo.	27-36

[a] 24-30S depending on whether thesis option is taken

[b] Formal requirements for the doctoral degree include 30S and 6S residence beyond the bachelor's degree. A preliminary exam at the completion of course work and a final exam after the dissertation is completed are required.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 444[1]	Sanitary Engineering Lab I	Bennett	3S	S'73	17
CE 448[1]	Intro. to Environmental Pollution	Linstedt	3S	F'72	34
CE 541[1]	Unit Operations in Sanitary Engr.	Weers	3S	F'72	7
CE 341	Sanitary Engineering I	Linstedt	4S	S'73	30
CE 548[1]	Public Health Engineering	Linstedt	3S	F'72	7
CE 542[1 2]	Advanced Water Supply	Jorden	3S	S'73	11
CE 533[1,2]	Applied Hydrology	Weers	3S	S'73	11
CE 539[1,2]	Seminar in Water Resources	-	-	-	-
CE 540	Water Pollution Chemistry	Jorden	3S	F'72	6
CE 543[1,2]	Advanced Wastewater Treatment	Bennett	3S	F'72	12
CE 547[1]	Sanitary Engineering Processes Lab	Linstedt	3S	S'73	7
CE 442	Municipal Design	Bennett	3S	S'73	19
CE 631	Advanced Hydraulics	Hughes	3S	F'72	8
CE 635[2]	Hydraulic Design I	Hughes	3S	F'72	9
CE 544[1]	Sanitary Engineering Lab II	Weers	3S	F'72	8
CE 545[1]	Adm. Public Works	Staff	3S	S'73	25

CE 595[1,2]	Independent Study (Design of Water & Wastewater Treatment Plants)	-	-	-	-
CE 531[2]	Intermediate Fluid Mechanics	-	-	-	-
CE 534[2]	Hydraulics of Open Channels	Hughes	3S	S'73	16
CE 700[1,2]	Thesis	-	-	-	-
ChE 568	Industrial Pollution Control	Kreith	3S	F'72	15
ChE 569	Industrial Control & Solid Waste Pollution Control	West	3S	S'72	30
ChE 594	Selected Topics	Krantz	3S	S'73	8

[1] Sanitary Engineering Option

[2] Water Resources Engineering Option

Faculty

EDWIN R. BENNETT
Associate Professor
Department of Civil and Environmental Engineering
1965

BSCE	Washington University-St. Louis	Civil Engineering	1956
MSSE	Washington University-St. Louis	Sanitary Engineering	1959
PhD	University of California-Berkeley	Sanitary Engineering	1967

Water reuse, individual home sewage disposal, municipal design

100% (70% teaching, 30% research)

"A Radioactive Tracer Technique for Molecular Diffusion Coefficients in Granular Media," Analytical Chemistry, 43, 55, January 1972 (with W. E. Bolch)

"Economic Aspects of Sludge Dewatering and Disposal," Journal American Society of Civil Engineers, Environmental Engineering Division, 99, EE1, p. 55, February 1973 (with K. D. Linstedt)

"Individual Home Aerobic Wastewater Treatment Systems," Proceedings of the University of Kansas Sanitary Engineering Conference, 1973 (with K. D. Linstedt and R. N. McBride)

"Optimize Solids Control," Water and Wastes Engineering, 8-5, p. 46, 1971 (with K. D. Linstedt and D. B. Cohen)

"Disposal of Wastewater Concentrates," Chapter 2 of Air and Water Pollution, Colorado University Press, 1972

"Treatment Process Evaluation for Successive Water Use," Federal Water Quality Administration, 6/69-5/72 and Denver Water Department, 3/72-3/75, co-principal investigator

"Performance of Small Unit Wastewater Disposal Systems in Mountain and Rural Applications," Office of Water Resources Research, 6/72-6/74, co-principal investigator

"Vacuum Filtration--Conditioning and Media Effects," Kettering Foundation, 6/68-6/70, principal investigator

Registered professional engineer: Colorado and Kentucky

Previous full-time professional experience: 3 yrs. (1 yr. industry, 1 yr. consulting, 1 yr. military)

Member, AEEP
Member, AEEP Manpower Committee
Trustee, Rocky Mountain Section, Water Pollution Control Association
Reviewer, American Water Works Association Journal

ROGER M. JORDEN
Assistant Professor
Department of Civil and Environmental Engineering
1968

BS	University of Texas	Geology	1959
MS	University of Arizona	Hydrology	1962
PhD	University of Illinois-Urbana	Civil Engineering	1968

Physical-chemical water and wastewater treatment, water chemistry, colloid chemistry, trace metals

100% (75% teaching, 25% research)

"Rapid Mixing in Water Treatment," Journal American Water Works Association, 63, 52-58, 1971 (with Lasse Vrale)

"Coagulation-Flocculation, Part I," Water and Sewage Works, 118 (1), 23-25, 1971

"Coagulation-Flocculation, II--Double Layer Repression," Water and Sewage Works, 118 (2). 43-47, 1971

"Coagulation-Flocculation, III--Adsorption," Water and Sewage Works, 118 (3[illegible]77-79, 1971

"Coagulation in Water Treatment," in Air and Water Pollution NSF Workshop on [illegible] and Water Pollution, (R. West and R. Williams eds.), Colorado Association University Press, Boulde[illegible] 1972

"Molybdenum in the Environment," National Science Foundation (RANN), 6/72-6/74, co-investigator

"Treatment of Wastewater by Lime Precipitation--Dissolved Air Flotation," CRCW, 9/72-8/73

"Air and Water Pollution Workshop," National Science Foundation (IRRPOS), 8/70, co-investigator

Previous full-time professional experience: 2 yrs. (industry)

Member, AEEP
Member, Water Pollution Control Federation
Member, American Water Works Association
Member, American Association for the Advancement of Science
Proposal Review, National Science Foundation
Participant in National Academy of Science--National Research Council, Subcommittee on the Geotechnical Environment in Relation to Health and Disease, Workshop Conference, Pacific Grove, California (February 1972)

WILLIAM C. HUGHES
Assistant Professor
Department of Civil and Environmental Engineering
1968

BS	University of New Mexico	Civil Engineering	1960
BS	University of Utah	Meteorology	1961
MS	University of New Mexico	Civil Engineering	1964
PhD	University of New Mexico	Civil Engineering	1969

Water resources management, hydraulics and fluid mechanics, survey course environmental pollution, evaporation and plant transpiration

60% (40% teaching, 20% research)

"Simulation of Salt Cedar Evapotranspiration," Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, 98, IR4, Proceedings Paper 9415, pp. 533-542, December 1972

"Economic Feasibility of Increasing Pecos River Basin Water Supplies through Reduction of Evaporation and Evapotranspiration," Water Resources Research Institute Report No. 9, New Mexico State University, pp. 1-38, June 1970

"Flood Control Release Optimization Using Methods from Calculus," Journal of the Hydraulics Division, American Society of Chemical Engineers, 97, HY5, Proceedings Paper 8117, pp. 691-703, May 1971

"Energy Balance Model for Estimating Salt Cedar Water Consumption," National Science Foundation, 4/71-9/72, principal investigator

Registered professional engineer: Colorado

Previous full-time professional experience: 2 yrs. (government)

K. D. LINSTEDT
Assistant Professor
Department of Civil and Environmental Engineering
1967

BS	Oregon State University	Civil Engineering	1962
MS	Stanford University	Civil Engineering	1963
PhD	Stanford University	Civil Engineering	1968

Tertiary treatment, wastewater treatment, water reuse

100%

"Development of Successive Water Use in a Metropolitan Area," Journal American Water Works Association, 63, pp. 610-615, 1971 (with K. J. Miller and E. R. Bennett)

"Quality Considerations in Successive Water Use," Journal Water Pollution Control Federation, 43, pp. 1681-1694, 1971 (with E. R. Bennett and S. W. Work)

"Trace Element Removals in Advanced Wastewater Treatment Processes," Journal Water Pollution Control Federation, 43, pp. 1507-13, 1971 (with C. P. Houck and J. T. O'Connor)

"Treatment Process Evaluation for Successive Water Use," Denver Board of Water Commissioners, 3/72-3/75, co-principal investigator

"Evaluation of Treatment for Urban Wastewater Reuse," Environmental Protection Agency, 6/69-5/72, co-principal investigator

"Behavior of Trace Elements in Water Reclamation Treatment Processes," Kettering Foundation, 6/68-6/69, co-principal investigator

Registered professional engineer: Colorado

Member, Joint American Water Works Association-Water Pollution Control Federation Committee for Policy Statement on Water Reuse for Potable Supply
Vice President, Rocky Mountain Water Pollution Control Association
Reviewer, Journal Environmental Engineering Division, American Society of Civil Engineers
Reviewer, Research Proposals, Environmental Protection Agency

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J. ERNEST FLACK
Professor
Department of Civil and Environmental Engineering
1955

BS	Colorado State University	Civil Engineering	1950
MS	University of Iowa	Mechanics and Hydraulics	1954
PhD	Stanford University	Civil Engineering	1965

Water resources management, water law, hydrology, fluid mechanics

100% (40% teaching, 40% research, 20% administration)

"Consultant's Report on Resources," in Public Water Supply Treatment Technology, American Water Works Association Research Foundation Report for Office of Water Resources Research, 1973

"New Techniques for Participative Planning in Water Resources," Proceedings, International Symposium on Uncertainties in Hydrologic and Water Resource Systems, II, University of Arizona, December 11-14, 1972

"New Roles for Urban Water Management," Modern Government, Intercontinental Publications, Inc., Stanford, Connecticut, April 1972

"Program to Study Effects of Metering Residential Water Users in Denver," Board of Water Commissioners, 7/72-6/73, principal investigator

"Economic, Political and Legal Aspects of Colorado Water Law," Office of Water Resources Research Allotment, Colorado State University, 7/11/69-6/30/72, co-principal investigator

Registered professional engineer: Colorado

Previous full-time professional experience: 3 yrs. (consulting and government)

Member, Executive Board, Universities Council on Water Resources
Member, American Water Works Association; Member, Distribution System Research Committee
Member, American Society of Civil Engineers; Member, Education Committee of Technical Council on Water Resources Planning and Management

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WALTER A. WEERS
Associate Professor
Department of Civil and Environmental Engineering
1954

BSCE	University of Minnesota	-	1949
MSCE	University of Minnesota	Sanitary Engineering	1951
PhD	Clemson University	Environmental Systems Engineering	1972

Biokinetics, solids-liquid separation, process control, unit operations

100% (75% teaching, 15% research, 10% administration)

"A Review of the Theory and Control of Corrosion," Water and Sewage Works, 114, 5, May 1967 (with E. J. Middlebrooks)

"Simulations of a Continuous Culture of Microorganisms with Organism Separation and Recycle," Applications of Analog Computers in Sanitary Engineering, Proceedings of the 3rd Annual American Association of Professors in Sanitary Engineering Workshop, June 1968

Registered professional engineer: Colorado

Previous full-time professional experience: 3 yrs. (academic)

Member, AEEP
Member, American Society of Engineering Education; past president of local chapter
Member, Rocky Mountain Water Pollution Control Association; past trustee
Member, American Society of Civil Engineers; past member of local committee
Member, American Water Works Association; past program chairman for local section, past member of local section committees
Member, International Association on Water Pollution Research

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RONALD E. WEST
Associate Professor
Department of Chemical Engineering
1957

BSE	University of Michigan	Chemical Engineering	1954
MSE	University of Michigan	Chemical Engineering	1955
PhD	University of Michigan	Chemical Engineering	1958

Industrial water pollution control, interaction technology with legal-political systems, modeling wastewater treatment processes, kinetics of biological reactions, oil spill cleanup

75% (25% teaching, 50% research)

Registered professional engineer: Colorado

Member, American Institute of Chemical Engineers
Member, American Chemical Society
Member, Water Pollution Control Federation

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	12	2	10	1	17	1	28	2	20	2	ENROLLMENT
	Doctoral	2	0	4	1	3	1	3	1	3	1	

		68-69	69-70	70-71	71-72	72-73	
Environmental Engineering	Master's	5	5	9	21	15	GRADUATES
	Doctoral	1	1	1	3	1	

		68-69	
Environmental Engineering	Master's	3	NON-US NATIONALS
	Doctoral	1	

	Master's	Doctoral	
EPA traineeship	15	0	SUPPORT
EPA doctoral	0	1	
Research assistantship	5	0	
Teaching assistantship	0	1	
Government employer	2	1	
Industrial employer	1	0	
Consultant employer	1	1	
Self-supported	1	0	

	Master's	Doctoral	
Consulting	20	20	EMPLOYMENT (%)
Federal government	50	0	
Other government	10	0	
Academic	0	20	
Military	20	60	

Facilities

The total area of laboratory facilities housed is 3600 sq ft plus a fluids laboratory. The pilot plant at the Denver Metro Sewage Treatment Plant is successively used for open area research. Facilities include a completely equipped chemistry and microbiology laboratory (1200 sq ft), research areas (600 sq ft) and a large process laboratory. Library and computer facilities are available.

Colorado State University

Fort Collins, Colorado

Civil Engineering Department
College of Engineering

Environmental Engineering

ECPD Accredited--Civil Engineering Department

Dr. John C. Ward, Professor in Charge
Environmental Engineering Program
Civil Engineering Department
Colorado State University
Fort Collins, CO 80521
(303) 491-8674

May 1973

Environmental engineering at Colorado State University includes sanitary engineering (water quality engineering), air quality engineering, environmental radiation engineering, and solid waste engineering. The Master's degree program in environmental engineering permits graduate students to pursue a common curriculum that constitutes the bulk of their academic program. Approximately 58 percent of this core curriculum consists of the unit operations and unit processes of environmental engineering where the basic principles of these operations and processes common to water, air, solid wastes, and environmental radiation are emphasized. Each graduate has better training and greater opportunities because of his enhanced capability in all major areas of environmental engineering. The doctoral-level degree program is based on the foregoing Master's degree program and exploits the efficiencies produced in the Master's program. Specifically, the alternatives made possible by the Master's program include a broader environmental engineering education, or greater depth in one or more fields of environmental engineering, or a combination of these alternatives.

Colorado State University is a typical land-grant institution with a heavy emphasis upon engineering and the applied natural sciences. Current enrollment is about 15,000 with approximately 2,000 graduate students. Affiliated organizations include: Colorado Cooperative Fishery Unit, Colorado Cooperative Wildlife Research Unit, Colorado State Forest Service, Colorado State University Experiment Station, Cooperative Extension Service, Rocky Mountain Forest and Range Experiment Station, and the Solar Energy Application Laboratory. Tuition and fees for full-time graduate students are $570 (Colorado resident) and $1,759 (nonresident).

The three campuses of Colorado State University are located in or near the city of Fort Collins, a community of more than 43,000 which is located 65 miles north of Denver on Interstate 25 and 45 miles south of Cheyenne, Wyoming. Fort Collins is within an hour's drive of such major recreational areas as Estes Park, Red Feather Lakes, Horsetooth Reservoir, and several mountain parks, including the 790,000-acre Roosevelt National Forest and Rocky Mountain National Park. A broad spectrum of cultural and outdoor recreational facilities, the excellent climate, and the mountain surroundings contribute toward making Fort Collins an ideal college setting.

Admission Requirements

(a) Cumulative GPA of 3.0/4 or higher.

(b) GRE is not required.

(c) Provisional admission is possible for students whose grades average between 2.7 and 3.0 and whose academic background are deficient or not current, or whose degrees are from universities outside the US. Nondegree admission is possible for students whose grades average 2.7 or higher and who wish to enrich or to further their education without reference to advanced degrees. Credits earned by students admitted as nondegree may be used in meeting advanced degree requirements when recommended by departmental committees and approved by the graduate dean. Before such action can be considered, however, students must be admitted by regular or provisional admission. Students must obtain a 3.0/4 in the first quarter to obtain full graduate standing.

(d) Minimum score on TOEFL examination for foreign students is 550.

(e) Undergraduate disciplines normally acceptable for admission to the program include most engineering disciplines at accredited institutions.

(f) Make-up courses or prerequisites required of nonengineers entering the program include ordinary differential equations, fluid mechanics, and thermodynamics.

(g) Two copies of official transcripts of all previous college or university work must be submitted to the department. To be official, transcripts must bear the seals of the issuing institution and must be sent by them directly to the department.

(h) Admission to the doctoral program requires a 3.0/4 or higher for all work completed for the Master's degree.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engr. (Plan A)[a]	39Q	Yes	No	24 wk.	18
MS--Civil Engr. (Plan B)[a]	48Q	No	No	24 wk.	12
PhD--Civil Engr.	90Q	Yes	No	48Q	36

[a] Final comprehensive examination required.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 440	Environmental Health Engineering	J. C. Ward	3Q	S'73	50
CE 501	Nuclear Civil Engineering	D. S. Ward	3Q	NEW'73	-
CE 512	Hydraulics of Open Channels	Koloseus	3Q	W'73	32
CE 541	Principles of Aqueous Chemistry	Osteryoung	3Q	F'72	17
CE 542	Water & WW Analysis Lab.	Osteryoung	4Q	W'73	7
CE 544	Water Resources Planning	Thomas	3Q	W'73	25
CE 545	Principles of Systems Engineering	Smith	4Q	F'72	19
CE 601	Intermediate Fluid Mechanics I	Sadeh	4Q	F'72	17

CE 602	Intermediate Fluid Mechanics II	Sadeh	3Q	W'73	15
CE 603	Transport Phenomena	Karaki	3Q	S'73	6
CE 604	Struct. & Envir. Aerodynamics	Cermak	3Q	S'73	8
CE 613	Dimensional Analysis & Model Tech.	Gessler	3Q	F'72	13
CE 637	Envir. Anal. of Large Scale Develop.	Hendricks	2Q	F'73	11
CE 638	Unit Operations of Envir. Engr. I	J. C. Ward	3Q	F'72	29
CE 639	Unit Operations of Envir. Engr. II	Hendricks	3Q	W'73	25
CE 640	Unit Processes of Envir. Engr. I	Hendricks	4Q	S'73	19
CE 641	Unit Processes of Envir. Engr. II	J. C. Ward	2Q	NEW'73	-
CE 642	Unit Operations of Envir. Engr. III	Löf	3Q	W'73	8
CE 643	Unit Oper. & Proc. of Solid Waste Processing	Hendricks	3Q	NEW'73	-
CE 644	Technology Assess. & Forecasting	Vlachos	2Q	W'73	15
CE 724	Water Quality Hydrology	J. C. Ward	3Q	S'73	30
CE 741	Principles of Desalination	Löf	3Q	S'73	7
CE 745	Water Systems Engineering	Albertson	4Q	S'73	12
AT 570	Air Pollution	Staff	3Q	S'73	-
AT 670	Atmospheric Constituents	Staff	3Q	W'73	-
AT 671	Atmospheric Constituents Lab.	Staff	1Q	W'73	-
AT 720	Environmental Climatology	Staff	4Q	Su'72	-
C 381	Physical Chemistry I	Staff	3Q	F'72	-
C 383	Physical Chemistry II	Staff	3Q	W'73	-
C 385	Physical Chemistry III	Staff	3Q	S'73	-
MB 408	Microbiology of Water & Sewage	Staff	4Q	W'73	-
ME 480	Thermal Environmental Engr.	Staff	3Q	W'73	-
ME 680	Surface Phenomena	Staff	3Q	S'73	-
ME 881	Mechanics of Aerosols	Staff	4Q	F'72	-
R 525	Nuclear Radiation Physics	Staff	4Q	F'72	-
R 550	Radiobiology	Staff	4Q	S'73	-
R 663	Neutron Activation Analysis	Staff	3Q	S'73	-
R 664	Radiochemical Techniques	Staff	3Q	W'73	-
R 665	Radiation Chemistry	Staff	2Q	W'73	-
R 670	Radioecology	Staff	4Q	S'73	-
R 741	Radiological Physics	Staff	3Q	S'73	-
R 751	Radiation Dosimetry	Staff	4Q	W'73	-
R 761	Radiation Public Health	Staff	3Q	F'72	-
R 861	Radiation Biology I	Staff	3Q	F'72	-
R 862	Radiation Biology II	Staff	2Q	W'73	-

CE 637, 638, 639, 640, 641, 642, and C 381, 383, 385 are required of all environmental engineering majors.

Faculty

JOHN C. WARD
Professor in Charge
Environmental Engineering Program
Civil Engineering Department
1965

BS	University of Oklahoma	Petroleum Engineering	1957
ME	University of Oklahoma	Sanitary Engineering	1958
PhD	University of Oklahoma	Engineering Sciences	1961

Water and wastewater engineering, water quality hydrology, environmental radiation, probability theory and stochastic processes, population estimation and forecasting

100% (25% teaching, 65% research, 10% administration)

"Evaluation of the Effect of Impoundment on Water Quality in Cheney Reservoir," Colorado State University Sanitary Engineering Paper No. 4, 80 pages, September 1969 (with S. Karaki)

"Turbulent Flow in Porous Media," Journal of the Hydraulics Division, American Society of Civil Engineers, 90, HY5, Proc. Paper 4019, pp. 1-12, September 1964. Closure, 92, HY4, Proc. Paper 4859, pp. 110-121, July 1966. Digest, Transactions, American Society of Civil Engineers, 131, pp. 664-666, 1966

"Annual Variation of Stream Water Temperature," Journal Sanitary Engineering Division, American Society of Civil Engineers, 89, SA6, Proc. Paper 3710, pp. 1-16, December 1963. Closure, 91, SA1, Proc. Paper 4213, pp. 69-74, February 1965. Digest, Transactions, American Society of Civil Engineers, 130, pp. 258-260, 1965.

"Economics of Thermal Pollution Control," Journal Water Pollution Control Federation, pp. 2102-2116, December 1970 (with George O. G. Löf)

Radioactivity of Nuclear Reactor Cooling Fluids, Oak Ridge National Laboratory Report Number 3152, Oak Ridge, Tennessee, September 20, 1961

"Evaluation of the Effect of Impoundment on Water Quality in Cheney Reservoir," US Bureau of Reclamation, 6/68-9/69, principal investigator

"Concentration of Brines from Inland Desalination Plants by Spray Evaporation," Office of Saline Water, 9/70-12/71, co-investigator

"Solar Evaporation of Wastewater from Isolated Mountain Cabins," Office of Water Resources Research, 7/72-6/75, principal investigator

Registered professional engineer: Colorado and Arkansas

Previous full-time professional experience: 4 yrs. (academic and research)

Member, AEEP
Diplomate, AAEE

DAVID W. HENDRICKS
Associate Professor
Civil Engineering Department
1970

BS	University of California	Civil Engineering	1954
MS	Utah State University	Irrigation Engineering	1960
PhD	University of Iowa	Sanitary Engineering	1965

Systems analysis and waste management, environmental assessment of large-scale building, physical chemistry applications to unit operations and water quality, water resources

100% (30% teaching, 70% research)

Environmental Design and Public Projects, forthcoming, 1973 (co-editor et al.)

"Water Reuse Systems Analysis," Journal Sanitary Engineering Division, American Society of Civil Engineers, SA1, February 1971 (with A. B. Bishop)

"Thermodynamic Analysis of a Primary Oxidation Pond," forthcoming in 1973 in Journal Water Pollution Control Federation (with W. D. Pote)

"Simulation of Spatial and Temporal Changes in Water Quality within a Hydrologic Unit," Water Resources Bulletin, Journal American Water Works Association, 6, 4, August 1970 (with N. P. Dixon)

"Interdisciplinary Engineering for Public Works Projects," National Science Foundation, 7/71-5/73, principal investigator

"Bacterial Adsorption on Soils," Environmental Protection Agency, 7/68-6/70, co-principal investigator

"Sequential Use within a Hydrologic Complex," Environmental Protection Agency, 2/66-10/69, principal investigator

Registered professional engineer: Idaho, Utah, and Colorado

Previous full-time professional experience: 12 yrs. (1 yr. government, 11 yrs. academic)

Member, AEEP
Diplomate, AAEE
Consultant to private and governmental organizations

GEORGE O. G. LÖF
Professor
Civil Engineering
1967

BS	University of Denver	Chemical Engineering	1935
ScD	Massachusetts Institute of Technology	Chemical Engineering	1940

Industrial waste treatment and economics, water desalting technology, environmental impact of energy conversion

60% (20% teaching, 40% research)

Technology in American Water Development, Johns Hopkins University Press, April 1959 (with E. A. Ackerman)

Water Demand for Steam Electric Generation, Johns Hopkins University Press, 1965 (with Paul Cootner)

The Economics of Water Utilization in the Beet Sugar Industry, published by Johns Hopkins University Press for Resources for the Future, Inc., 1968 (with A. V. Kneese)

"Integrated Residuals Management in the Pulp and Paper Industry," paper presented February 1972 and accepted for publication in American Institute of Chemical Engineers publication (in press) (with B. T. Bower and W. M. Hearon)

"Storage Requirements for Water in the United States," Water Resources Bulletin, 2, 3, 1966 (with C. H. Hardison)

"Residuals Management in Pulp and Paper Manufacture," Resources for the Future, Inc., 1968-date, co-investigator

"Disposal of Desalting Plant Brines by Spray Evaporation," Office of Saline Water, US Department of the Interior, 6/68-9/69, co-investigator

"Cooling and Biotreatment of Beet Sugar Factor Condenser Water," Office of Saline Water, US Department of the Interior, 7/69-6/71, co-investigator

Registered professional engineer: Colorado

Previous full-time professional experience: 27 yrs. (12 yrs. academic, 7 yrs. consulting, 7 yrs. research and development, 1 yr. industry)

Member, American Chemical Society; past President, Colorado section
Member, American Institute of Chemical Engineers; member, various committees
Member, International Solar Energy Society; past director; current President
Consultant, National Science Foundation; site visit team member; solar energy panel member
Exchange Scientific Visitor USSR, National Academy of Science

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JANET OSTERYOUNG
Assistant Professor
Civil Engineering and Microbiology
1969

BA	Swarthmore College	Chemistry	1961
PhD	California Institute of Technology	Chemistry	1967

Analytical chemistry, aquatic chemistry, chemical toxicology and epidemiology

75% (17% teaching, 58% research)

"Nitrates and Human Health," Proceedings, Symposium on Environmental Chemicals--Human and Animal Health, Colorado State University, Fort Collins, Colorado, August 1972

"Arsenic Oxidation State in the Presence of Microorganisms: Examination by Differential Pulse Polarography," Environmental Letters, 5, 1, 1973 (et al.)

"Analysis for Arsenic (III) at the Parts per Billion Level by Differential Pulse Polarography," Analytical Chemistry, 45, pp. 267-271, 1973 (with David J. Myers)

"Analytical Pulse Polarography," National Science Foundation, 12/71-12/74, co-principal investigator

Previous full-time professional experience: 3 yrs. (2 yrs. postdoctoral, 1 yr. academic)

EVAN VLACHOS
Professor
Sociology and Civil Engineering
1967

LLB	University of Athens	Law	1959
MA	Indiana University	Sociology	1962
PhD	Indiana University	Sociology	1964

Technology assessment, futurism, environmental assessment, demography, urban planning

"The Human Community," Chapter 6 in Environmental Design and Public Projects, NSF Report, 1973 (ed. et al.)

"Urban Growth and Natural Resources," in Urban Demands on Natural Resources, Proceedings of the 1970 Western Resources Conference, University of Denver Press, 1970

"Social Processes in Water Management Systems," in Treatise on Urban Water Systems, Colorado State University, 1971 (ed. et al.)

"Research in Demography and Modernization," Agency for International Development, 1970-date, project coordinator

"Impact of Urbanization and Industrialization in Northern Colorado," 1969-71, project director

Consultant, Town Planning Division of Greater Athens, Greece (1965-67, 1971)
Consultant, Army Corps of Engineers (1973)

DAN S. WARD
Research Associate
Civil Engineering Department
1973

BES	University of Texas	Engineering Science	1963
PhD	University of Texas	Nuclear Physics	1971

Solar energy conversion and application, architectural/environmental concerns, nuclear conversion

100% (40% research, 30% administration, 30% teaching)

"Analysis of Solar Thermal Electric Power Systems," National Science Foundation, 5/73-10/74, co-investigator

Previous full-time professional experience: 2 yrs. (1 yr. academic and 1 yr. industry)

Member, American Physical Society
Member, American Association of Physics Teachers

S. M. MORRISON
Professor
Microbiology, College of Veterinary Medicine and Biomedical Sciences

PhD	Ohio State University	Microbiology	1950

Research in cold temperature waste treatment, animal waste, ground water pollution
90%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Civil Engineering	Master's	76	-	54	-	56	-	72	-	97	-	ENROLLMENT
	Doctoral	50	-	44	-	59	-	65	-	73	-	
Environmental Engineering	Master's	6	-	4	-	5	-	21	-	15	-	
	Doctoral	0	-	1	-	4	-	4	-	3	-	
Civil Engineering	Master's	50		26		28		28		44		GRADUATES
	Doctoral	24		11		15		18		26		
Environmental Engineering	Master's	5		1		0		4		1		
	Doctoral	0		0		0		1		0		
Environmental Engineering	Master's	6		NON-US NATIONALS								
	Doctoral	0										

	Environmental Engineering		
	Master's	Doctoral	
EPA traineeship	3	0	SUPPORT
EPA doctoral fellowship	0	1	
Research assistantship	9	1	
Government employer	3	1	
Consulting firms	18	100	EMPLOYMENT (%)
Industry	18	0	
Federal government	9	0	
Other government	18	0	
Academic	9	0	
Further study	18	0	
Unknown	10	0	

Facilities

Three of the four environmental engineering laboratories are in the $5,250,000 Engineering Research Center located on the foothills campus of Colorado State University. These laboratories contain, in addition to the equipment that is normally available in typical environmental engineering programs, a Precision Scientific Aquarator (does COD determinations in less than two minutes each), an ultrafiltration and reverse osmosis pilot plant, a Sargent-Welch Recording Titrator, a Turner Fluorometer, a Chemineer Experimental Agitator and Mixing pilot plant, Eppley Pyranometer (measures solar radiation), solar radiation integrator and totalizer-recorder, dew point hygrometer, twelve channel multipoint temperature recorder, net radiation exchange radiometer, etc.

Two water treatment plants, two lakes, and the Atmospheric Science Department building are immediately adjacent to the Engineering Research Center. The Engineering Research Center consists of a large, three-story office building with separate, large buildings housing the hydraulics, hydromechanics, and fluid dynamics and diffusion laboratories. Also at the Engineering Research Center is a 100-acre outdoor hydraulics and hydrology laboratory containing rainfall-runoff and snowfall-runoff facilities as well as a long 30-inch diameter variable slope circular pipe for study of fluid transport in both closed and open conduits and an atmospheric evaporation research facility.

The office building at the Engineering Research Center has shock tube, porous media, photogrammetry, and structural laboratories as well as graduate research assistant offices and a large reading room. Extensive supporting equipment includes digital (a CDC 6400 computer terminal) and analog computers.

Cornell University

Ithaca, New York

Agricultural Engineering Department
College of Agriculture and Life Sciences

Agricultural Waste Management

ECPD Accredited--Agricultural Engineering

Graduate Field Representative
Department of Agricultural Engineering
Riley-Robb Hall
Ithaca, NY

May 1973

The orientation of the agricultural waste management program at Cornell is towards the treatment, disposal, and utilization of wastes originating in the production of food and natural fibers. Specific areas of emphasis include agro-ecosystems analysis, rural environmental engineering, animal waste management, food processing waste management, identification and control of water pollution from land runoff, and land disposal of wastes. The following degrees are offered: MEng, MPS, MS, and PhD.

The MEng and MPS programs are designed for individuals wishing to pursue professional engineering (MEng) or engineering-related (MPS) careers related to agriculture and environmental quality or rural development which are not in the teaching or research area. In addition to formal course work, students are required to complete a project which is relevant to current problems and practices in their areas of interest. The MS and PhD degrees are appropriate to individuals contemplating research and teaching careers in agro-ecosystem management. Students in all four degree programs generally work with faculty and take course work from several departments including agricultural engineering, natural resources, agronomy, sanitary engineering, agricultural economics, food science, and biological sciences. Tuition is approximately (1973) $3200 for MEng candidates and $1600 for MPS, MS, and PhD candidates.

Cornell University, located in the Finger Lakes region of central New York State, has an enrollment of nearly 16,000 undergraduate and graduate students. It is a land grant institution which includes both privately and publicly supported colleges. Its libraries contain approximately 4,000,000 volumes. Facilities for agricultural waste management research include the 8,000 square feet agricultural waste management laboratory which provides 5,000 square feet for pilot plant studies. Research and demonstration activities are conducted at several full-scale food processing and animal production facilities.

Admission Requirements

(a) 3.0/4 in last two years of college.

(b) GRE is optional for MEng, MS, PhD; if taken, a combined score of 1200 is desirable. GRE is required for MPS.

(c) Provisional admission is possible for students with unusual or uncertain educational background. Students are permitted one trial term in this status.

(d) A minimum TOEFL score of 550 for non-English speaking applicants.

(e) Any engineering background is normally acceptable. Degrees in the physical and biological sciences may be acceptable.

(f) Make-up courses or prerequisites required at the direction of student's advisor or graduate committee.

(g) Other admission requirements include: ranking within top one-third of graduating class, two letters of recommendation from appropriate academic people attesting to the excellent intellectual ability and motivation of the applicant.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MEng	30S	Project	No	2S	9-12
MPS	30S	Project	No	2S	9-12
MS	a	Yes	No	2S	15-18
PhD	a	Yes	No	4S[b]	36

[a] MS and PhD candidates do not have minimum course requirements. Course schedules are developed with student's graduate committee to satisfy his background, needs, and program objectives.

[b] For students holding Master's degrees.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
Ag Eng 310	Ag. Practices & Envir. Quality	Ludington	2S	NEW'73	-
Ag Eng 421	Intro. to Environmental Pollution	Ludington	3S	S'73	170
Ag Eng 475	Systems Models for Envir. Qual. Cont.	Haith	3S	S'73	30
Ag Eng 504	Biological Engineering Analysis	Cooke	4S	F'72	5
Ag Eng 506	Industrial Waste Engineering	Loehr Behn Edwards Wiegandt	3S	S'73	22
Ag Eng 507	Treatment & Disposal of Ag. Wastes	Loehr	3S	S'73	14
Ag Eng 510	Envir. Qual. Mgt. for Agro-Ecosystems	Haith Shoemaker	3S	F'72	8

Agron 306	Soil Microbiology	Alexander	3S	S'73	50
Bio Sci 462	Limnology	Likens Hall	3S	S'73	45
Civ Eng 2510	Chemistry of Water & Wastewaters	Bisogni	3S	F'72	45
Civ Eng 2513	Biological Phenomena & Practices	Lawrence	3S	F'72	26
Civ Eng 2514	Chem. & Phys. Phenomena & Processes	Lawrence	3S	S'72	24
Nat Res 443	Ecological Aspects of Water Res. Mgt.	Oglesby	3S	F'72	40

Faculty

DOUGLAS A. HAITH
Assistant Professor
Agricultural Engineering and Civil Engineering
1971

SB	Massachusetts Institute of Technology	Civil Engineering	1964
SM	Massachusetts Institute of Technology	Civil Engineering	1966
PhD	Cornell University	Civil Engineering	1971

Management of agricultural systems for environmental quality control, environmental systems analysis, water-resource systems

100% (50% teaching, 50% research)

"A Model for Land Disposal of Nitrogenous Wastes," presented at 74th National Meeting, American Institute of Chemical Engineers, New Orleans, March 1973

"Estimating the Political Feasibility of Alternative Water-Resource Plans," Proceedings, II, International Symposium on Mathematical Modelling Techniques in Water Resources Systems, Ottawa, 1972 (with D. P. Loucks)

"Management of Nutrients to Optimize Environmental Quality in Relation to Agricultural Production," Rockefeller Foundation, 1/71-12/74, co-principal investigator

Previous full-time professional experience: 2 yrs. (consulting)

WILLIAM J. JEWELL
Associate Professor
Agricultural Engineering
1973

BS	University of Maine	Civil Engineering	1963
ME	Manhattan College	Sanitary Engineering	1964
PhD	Stanford University	Environmental Engineering	1968

Biological and chemical mechanisms involved in pollution control, agricultural and rural waste management

100% (30% teaching, 70% research)

"Microbial Yield Dependence on Dissolved Oxygen in Suspended and Attached Systems," in Applications of Commercial Oxygen to Water and Wastewater Systems, Proceedings, 6th University of Texas Water Resources Symposium, 1972 (with S. E. Mackenzie)

"Comparison of Air and Oxygen in Aerobic Sludge Digestion," Proceedings, Purdue University Industrial Waste Conference, 1972 (with R. M. Stein and W. W. Eckenfelder)

"Aquatic Weed Decay: Dissolved Oxygen Utilization and Nitrogen and Phosphorus Regeneration," Journal Water Pollution Control Federation, 43, pp. 1457-1467, 1971.

"Rate and Extent of Carbon, Cycling in Lakes," presented at the American Chemical Society Meeting, Houston, Texas, 1970 (with P. L. McCarty, and E. G. Foree)

"Petrochemical and Refinery Waste Treatment Facilities," Environmental Protection Agency, 1971, co-investigator

"Waterfront Area Transportation and Environmental Resources," National Science Foundation, 1972, faculty advisor

Previous full-time professional experience: 5 yrs. (academic)

Member, AEEP
Consultant to consulting firms (1964-date)

RAYMOND C. LOEHR
Professor and Director
Environmental Studies Program, College of Agricultural and Life Sciences
Agricultural Engineering and Civil Engineering
1968

BS	Case Institute of Technology	Civil Engineering	1953
MS	Case Institute of Technology	Sanitary Engineering	1956
PhD	University of Wisconsin	Sanitary Engineering	1961

Treatment and disposal of agricultural wastes, process control, solid wastes, industrial waste treatment systems

100% (20% teaching, 30% research, 50% administration)

"Agricultural Runoff--Characteristics and Control," Proceedings, American Society of Civil Engineers, 98, SA6, 1972

"Microbial Nitrification and Denitrification in Concentrated Wastes," Water Research, 6, pp. 859-69, 1972 (with T. B. S. Prakasam)

"Animal Waste Management--Problems and Guidelines for Solutions," Journal of Environmental Quality, 1, 1972

"Drainage and Pollution from Beef Cattle Feedlots," Proceedings, American Society of Civil Engineers, 96, SA6, 1970

"Alternatives for the Treatment and Disposal of Animal Wastes," Journal Water Pollution Control Federation, 43, 1971

"Design Parameters for Animal Waste Treatment Systems," Environmental Protection Agency, 1972-74, co-principal investigator

"Management of Agricultural Wastes," Environmental Protection Agency Training Grant, 1969-74, director

"Management of Nutrients to Optimize Environmental Quality in Relation to Agricultural Production," Rockefeller Foundation, co-principal investigator

Registered professional engineer: Ohio and Kansas

Previous full-time professional experience: 8 yrs. (academic)

Member, AEEP
Association of Environmental Engineering Professors; President (1971); Director (1968-date)
Member, American Society of Civil Engineers, Sanitary Engineering Division; Secretary of Executive Committee (1965-69)
Director, Environmental Engineering Research Laboratory University of Kansas, 1965-68
Member, New York State Department of Health Council of Agricultural Advisors (1968-date)
Consultant to consulting firms (1962-date)

DAVID G. LUDINGTON
Associate Professor
Agricultural Engineering
1959

BS	Cornell University	Agricultural Engineering	1956
MS	Cornell University	Agricultural Engineering	1959
PhD	Purdue University	Agricultural Engineering	-

Management of agricultural wastes to reduce air and water pollution, treatment and disposal of poultry and dairy wastes

100% (40% teaching, 50% research, 10% extension)

"Control of Odors through Manure Management," Transactions, American Society of Agricultural Engineering, 14, 1971 (with A. T. Sobel and B. Gormel)

"Odors and Gases Liberated from Diluted and Undiluted Chicken Manure," Transactions, American Society of Agricultural Engineering, 14, 1971 (with A. T. Sobel and A. G. Hashimoto)

"Destruction of Solids on Severe Treatment," Proceedings, Cornell University Conference on Agricultural Waste Management, 1971

"Pilot Plant Comparison of Liquid and Dry Waste Management Systems for Poultry Manure," Proceedings, Cornell University Conference on Agricultural Waste Management, 1971

"Poultry Waste Handling System Design," Agricultural Research Service, US Department of Agriculture, 1970-72, principal investigator

"Problems of Poultry Waste Disposal and Odor Control," Agricultural Research Service, US Department of Agriculture, 1972-74

Member, American Society of Engineering Education
Member, American Society of Agricultural Engineers; committee member and committee chairman

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NORMAL C. DONDERO
Professor
Food Science Department
PhD Cornell University Microbiology 1952
Aquatic microbiology, microbiology of wastewaters
70%

PAUL J. ZWERMAN
Professor
Agronomy Department
PhD Ohio State University Soil Conservation 1949
Soil and water conservation, nutrient losses in agricultural runoff and seepage
70%

ROBERT R. ZALL
Associate Professor
Food Science Department
PhD Cornell University Dairy Science 1968
Treatment, disposal, and utilization of dairy processing wastes
50%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Agricultural Engineering	Master's	1	-	1	-	1	-	6	-	7	-	ENROLLMENT
	Doctoral	2	-	2	-	3	-	4	-	5	-	
Agricultural Engineering	Master's	-		1		1		4		5		GRADUATES
	Doctoral	-		-		-		1		-		
Agricultural Engineering	Master's	2		NON-US NATIONALS								
	Doctoral	2										

	Master's	Doctoral	
EPA traineeship	3	0	SUPPORT
Research/teaching assistantship	1	3	
Foreign government support	1	0	
Currently in absentia	2	2	

Consulting	10	0
Federal government	10	0
Other Government	30	0
Academic	0	100
Further Study	40	0
Unknown	10	0

Facilities

Facilities for research include two agricultural waste laboratories (10,000 sq ft); 92 one-half-acre ponds for aquatic studies; twenty-four 0.8-acre field plots for runoff and fertility studies; access through slow speed terminals (SST) to IBM 360/65 computer; SD 20 and 80 analog computers; and the Animal Science Teaching and Research Center, designed for full-scale environmental studies on dairy and milk production.

University of Delaware

Newark, Delaware

Department of Civil Engineering
College of Engineering

Civil Engineering
Applied Science

1833

ECPD Accredited--Civil Engineering

Dr. Richard I. Dick
Professor of Civil Engineering
356 DuPont Hall
University of Delaware
Newark, DE 19711
(302) 738-2431

February 1974

Graduate programs in the environmental engineering program of the Civil Engineering Department at the University of Delaware are individually tailored to match the background and needs of students. Courses are selected to assure special competence in either water quality control or air quality control. Master's degree candidates may work toward either a MCE or MAS Degree. Students with undergraduate degrees in engineering ordinarily seek the MCE Degree whereas those entering the program with undergraduate degrees in biology, chemistry, or other areas of the physical or natural sciences work toward the applied science degree.

The University of Delaware has an enrollment of approximately 17,000 students including about 3,700 continuing education students and over 2,000 graduate students. It is a land-grant institution and substantial programs exist in a wide variety of areas to provide educational opportunities meeting the varied needs of students in environmental engineering graduate programs. The University of Delaware also is a Sea Grant institution and environmental engineering students especially interested in problems of the marine environment can take elective courses in the College of Marine Studies. Tuition and fees for full-time students with residence in the State of Delaware is $525 per academic year and nonresident graduate tuition is $1500 (1973-74).

Newark, the home of the University of Delaware, is a community of about 25,000 people located fifteen miles southwest of Wilmington, Delaware. It is essentially a rural community, but attractions and environmental problems of the east coast megalopolis area are within easy reach.

Admission Requirements

(a) 2.5/4 for MCE or MAS.

(b) GRE combined score of 1050 is required; advanced examination is not required.

(c) Under exceptional circumstances provisional admission may be possible.

(d) A score of 550 on the TOEFL exam is required.

(e) Any engineering degree at an accredited institution is acceptable for candidates pursuing an MCE Degree. Individuals with degrees in chemistry, biology, or physics are admissible and advised to pursue the MAS option.

(f) Often an undergraduate course in mathematics and/or fluid mechanics is required during the first term for students without engineering backgrounds.

(g) Three letters of recommendation are required of all applicants as well as GRE scores and transcripts.

(h) Applicants for admission to the PhD program must have exhibited superior performance in a Master's program.

Degree Requirements

Degree	Credits[a]	Thesis	Language	Residence	Time (mo.)
MAS--Environmental Engr.	30S	Yes	No	-	12
MCE--Environmental Engr.	30S	Yes	No	-	12
MCE--Environmental Engr.[c]	33S	No	No	-	12
PhD--Environmental Engr.	72S[b]	Yes	No	1 yr.	42

[a] Includes thesis credit.

[b] Typical norm--no specific credit hour requirement.

[c] Comprehensive examination is required.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 630	Environmental Health Engineering	Staff	3S	S'72	23
CE 631	Water Quality & Pollution	Staff	3S	S'72	11
CE 632	Chemical Aspects of Envir. Engr.	Carberry	4S	F'73	7
CE 633	Physical Aspects of Envir. Engr.	Esmen	3S	F'73	8
CE 635	Air Resources Engineering	Esmen	3S	S'74	9
CE 636	Biological Aspects of Envir. Engr.	Dick	3S	F'73	19
CE 638	Industrial Hygiene	Esmen	3S	S'73	9
CE 667	Environmental Resources Seminar	Esmen	1S	S'74	10
CE 831	Theory of Water Treatment	Carberry	3S	S'74	9
CE 832	Theory of Waste Treatment	Dick	3S	S'74	12
CE 842	Design of Water & WW Treatment Sys.	Staff	3S	S'72	9

CE 856	Air Pollution Control	Esmen	3S	F'73	3
CE 866	Hydrologic Transport Processes	Ditmars	3S	S'73	6
CE 867	Environmental Engineering Seminar	Dick	1S	S'74	11

CE 632 and 633 normally are required of all Master's candidates. Additionally, those in the water program normally are required to take CE 636, 831, and 832 while students in the air program take CE 635 and 866.

Faculty

RICHARD I. DICK
Professor
Civil Engineering
1972

BS	Iowa State University	Civil Engineering	1957
MS	State University of Iowa	Sanitary Engineering	1958
PhD	University of Illinois	Sanitary Engineering	1965

Sludge treatment, reclamation, and disposal, solids separation in biological treatment, design of wastewater treatment facilities

100% (50% teaching, 50% research)

"Role of Activated Sludge Final Settling Tanks," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, SA2, pp. 423-436, 1970

"Sludge Treatment," in Physiochemical Processes for Water Quality Control (W. J. Weber, Jr., ed.), John Wiley and Sons, New York, pp. 533-596, 1972

"Gravity Thickening of Waste Sludges," Proceedings of the Filtration Society, Filtration and Separation, 9, 2, pp. 177-183, 1972

"Factors Influencing Batch Flotation Tests," Journal Water Pollution Control Federation, 45, 2, pp. 304-315, 1973 (with R. F. Wood)

"Thickening Characteristics of Activated Sludge," Advances in Water Pollution Research, Proceedings of 4th International Conference on Water Pollution Research, Prague, pp. 626-642, 1970

"Dynamic Response of Final Settling Tanks to Transient Loading Conditions," Office of Water Resources Research, 7/73-6/75, principal investigator

"Gravity Thickening of Sludges as a Batch Process," University of Delaware Research Foundations, Inc., 6/73-7/74, principal investigator

"Rheological Characterization of the Settling Behavior of Flocculent Suspensions," Office of Water Resources Research, 7/72-6/73, co-principal investigator

Registered professional engineer: Illinois

Previous full-time professional experience: 13 yrs. (2 yrs. government, 2 yrs. consulting, 9 yrs. academic)

Member, AEEP
President, Association of Environmental Engineering Professors (1973)
Member, Water Pollution Control Federation; member of research committees
Member, Environmental Engineering Division of the American Society of Civil Engineers; member of research committees

JOHN D. DITMARS
Assistant Professor
Civil Engineering and College of Marine Studies
1972

BSE	Princeton University	Civil Engineering	1965
MS	California Institute of Technology	Civil Engineering	1966
PhD	California Institute of Technology	Civil Engineering	1971

Mixing of wastewater, heat, and solids in hydrologic environment

50% (25% teaching, 25% research)

"Mixing of Density-Stratified Impoundments with Buoyant Jets," W. M. Keck Laboratory Report Number KH-R-22, California Institute of Technology, September 1970

"Analysis of Air-Bubble Plumes," W. M. Keck Laboratory Report Number KH-R-24, California Institute of Technology, September 1970 (with K. Cederwall)

"Analytical Modeling of Estuarine Circulation," Proceedings 13th International Conference on Coastal Engineering, Vancouver, July 1972

"Models for the Disposal of Waste-Solids into Coastal Waters," University of Delaware Research Foundation, 6/73-6/74, principal investigator

"Triple Bend Reach of Delaware Estuary," National Science Foundation (RANN), 6/72-6/73, co-investigator

Previous full-time professional experience: 2 yrs. (academic)

Associate Member, American Society of Civil Engineers
Member, Sigma Xi

NURTAN A. ESMEN
Assistant Professor
Civil Engineering
1970

Diploma	Roberts College		1956
BSME	Northeastern University	Mechanical Engineering Science	1965
MS	University of Pittsburgh	Air Engineering	1966
PhD	University of Pittsburgh	Chemical and Air Engineering	1970

Air pollution control, aerosols, colloidal physics, environmental engineering

100% (50% teaching, 50% research)

"Production of Aerosols," chapter in revised edition of Handbook of Aerosols, US Atomic Energy Commision (Richard Dennis, ed.), in press (with M. Corn)

"Resident Time of Particulate Matter in the Atmosphere," Atmospheric Environment, 5, 1971 (with M. Corn)

"Suspended Particulate Matter--Seasonal Variation in Specific Surface Area and Densities," Environmental Science and Technology, 5, 1970 (with M. Corn and T. L. Montgomery)

"Evaluation of University of Delaware Dust Photometer," University of Delaware Research Foundation, 6/71-6/72, principal investigator

"Investigation of Near Particle Interaction in Scavenging by Rainfall," University of Delaware Research Foundation, 6/73-5/74, principal investigator

"Investigation of the Environmental Impact of CdS and Cu_xS in Direct Energy Conversion," National Science Foundation, 6/72-11/72, co-principal investigator

Previous full-time professional experience: 4 yrs. (research and development)

Member, American Association for the Advancement of Science
Member, Air Pollution Control Association
Member, American Institute of Chemical Engineers
Member, Sigma Xi

JUDITH B. CARBERRY
Assistant Professor
Civil Engineering
1973

BS	Cornell University	Chemistry	1958
MS	University of Notre Dame	Environmental Chemistry	1970
PhD	University of Notre Dame	Environmental Engineering	1972

Solid, molecular, and ion transport; surface phenomena; mechanistic studies of environmental engineering treatment processes

100% (70% teaching, 30% research)

"Luxury Uptake of Phosphate by Activated Sludge," Journal Water Pollution Control Federation, 45 1973 (with M. W. Tenney)

"Nutrient Removal from Wastewater by Biological Treatment Methods," in Nutrients in Natural Waters (H. E. Allen and J. R. Kramer, eds.), John Wiley & Sons, Inc., New York, 1972 (*et al.*)

"Biological Uptake of Metabolites, Especially Phosphates," in Water--1972, American Institute of Chemical Engineers Symposium Series No. 129, 69, 1973

"Impacts of Detergents on the Environment," in Detergent Handbook, Vol. II (Gale Cutler, ed.), Marcel Dekker, Inc., New York, 1974 (with M. W. Tenney)

"Microbial Identification by Pyrolysis-Gas Liquid Chromatography," Proceedings of the 4th Annual Environmental Science and Engineering Conference, Louisville, Kentucky, 1974 (with W. F. Echelberger, Jr. and R. S. Bottei)

"Treatability of Non-Ionic Surfactants," University of Delaware Research Foundation, 6/1/74-5/31/75, principal investigator

Previous full-time professional experience: 5 yrs. (2 1/2 yrs. industry and 2 1/2 yrs. academic)

Member, American Chemical Society
Member, Water Pollution Control Federation
Member, Sigma Xi

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental	Master's	4	5	3	9	3	15	8	15	10	14	ENROLLMENT
Engineering	Doctoral	0	1	1	1	2	1	1	1	1	2	

		69-70	70-71	71-72	72-73	73-74	
Environmental	Master's	1	2	4	6	7	GRADUATES
Engineering	Doctoral	0	0	0	0	0	

Environmental	Master's	1	NON-US NATIONALS
Engineering	Doctoral	0	

	Master's	Doctoral	
Davis fellowship	3	0	SUPPORT
du Pont fellowship	1	0	
Research fellowship	3	0	
Teaching assistantship	2	1	
Government employer	1	0	
Self-supporting (part-time students)	14	2	

EMPLOYMENT (%)

	Master's and Doctoral
Consulting firms	25
Industry	30
Federal government	10
Other government	20
Further study	10
Military	5

Facilities

The environmental engineering laboratories at the University of Delaware are well equipped for both research and teaching. Instruments such as a carbon-hydrogen-nitrogen analyzer, atomic absorption spectrophotometer, UV-visible and IR spectrophotometers, a fluorimeter, and gas chromatograph are a part of the environmental engineering laboratories. More routine items such as balances, pH meters, a muffle furnace, ovens, an autoclave, etc. are also provided.

Duke University

Durham, North Carolina

Department of Civil Engineering
School of Engineering

Environmental Engineering

ECPD Accredited--Civil Engineering

Dr. Aleksander S. Vesic
Department of Civil Engineering
Duke University
Durham, NC 27706
(919) 684-2434

February 1974

The primary objective of the Duke University program in environmental engineering is to provide a quality education for men and women interested in designing solutions for the environmental problems that confront our increasingly complex society. Undergraduate preparation for this program should include a degree in engineering and an interest in natural and social sciences and their interface with engineering. This program of study will ordinarily require one to two years and leads to the MS Degree.

Students are encouraged to design their own programs of study, drawing their courses from those offered within and without the Department of Civil Engineering. In addition to the many related courses available at Duke University, students may elect to take courses in the Department of Environmental Sciences and Engineering at the University of North Carolina in nearby Chapel Hill. This department is world-renown for offering a wide variety of specialty courses within environmental engineering, and Duke students have unlimited access to their resources without sacrificing the small college/liberal arts atmosphere of Duke.

Admission Requirements

(a) 2.7/4 is considered as a guideline for admission.

(b) GRE is recommended but not required.

(c) Provisional admission is granted when appropriate.

(d) Foreign students must score a minimum of 550 on TOEFL test.

(e) Engineering degrees are normally required but degrees in natural sciences are acceptable.

(f) Nonengineers must complete some undergraduate requirements most appropriate to the graduate program.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	32S	Optional	No	1S	12
PhD--Civil Engineering	60S	Yes	No	2S	36

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 241	Environmental Chemistry & Biology	Drye	-	F'72	7
CE 247	Air Pollution Control	Vesilind	-	F'72	15
CE 248	Solid Wastes Engineering	Vesilind	-	S'73	8
CE 243	Unit Operations I	Vesilind	-	S'72	5
CE 244	Unit Operations II	Vesilind	-	S'73	4
CE 217	Urban Systems Analysis	Dajani	-	F'72	8
CE 225	Hydrology	Warner	-	F'71	6
CE 221	Incoming Fluid Flow	Muga	-	S'73	4
CE 223	Flow through Porous Media	Muga	-	F'72	4
CE 224	Coastal & Offshore Engineering	Muga	-	S'72	4
Forestry 243	Natural Resource Management	Wuenscher	-	F'72	25
Envir. 272[1]	Sanitary Engineering Design	Okun	-	F'72	15
Envir. 217[1]	Industrial Waste Treatment	Lamb	-	S'73	9
Envir. 1[1]	Chemical Reactor Theory	O'Melia	-	F'72	8
Envir. 271[1]	Modeling of Aquatic Systems	O'Melia	-	S'73	6

All Master's students are expected to take two courses in civil engineering other than in their major area of emphasis (e.g., environmental engineering). In addition, two courses outside the Department constitutes a minor.

[1] At the University of North Carolina-Chapel Hill

Faculty

P. AARNE VESILIND
Assistant Professor
Department of Civil Engineering
1970

BSCE	Lehigh University	Civil Engineering	1962
MSCE	Lehigh University	Civil Engineering	1964
MSSE	University of North Carolina	Sanitary Engineering	1965
PhD	University of North Carolina	Sanitary Engineering	1968

Wastewater solids disposal, solid wastes, physical-chemical processes

100% (80% teaching, 20% research)

"Estimation of Sludge Centrifuge Performance," Journal Sanitary Engineering Division, American Society of Civil Engineers, SA3, June 1970

"State-of-the-Art in Sludge Dewatering," Proceedings, 40th Annual Conference, Georgia Water Pollution Control Association, Augusta, September 1971

"Can We Predict Solids in Sludge Centrifugation?", Proceedings, 20th Southern Water Resources and Pollution Control Conference, Chapel Hill, North Carolina, April 1971

"Environmental Engineering Courses for Non-Engineers," Proceedings, 8th Annual Workshop, Association of Environmental Engineering Professors, Toronto, Ontario (with P. Singer and W. McLellon)

"Development of Self-Instructional Modules," Triangle Universities Consortium on Air Pollution, 1972-73

Registered professional engineer: North Carolina

Previous full-time professional experience: 2 yrs. (1 yr. consulting and 1 yr. research and development)

Member, AEEP
Diplomate, AAEE
Board Member, North Carolina Environmental Education Program

JARIR S. DAJANI
Assistant Professor
Department of Civil Engineering
1971

BEng	American University of Beirut	Civil Engineering	1961
MS	Stanford University	Construction Engineering	1966
PhD	Northwestern University	Urban Systems Engineering	1971

Urban systems, optimization of utilities, system dynamics

10%

"On the Centralization of Wastewater Treatment Facilities," paper presented at the 7th Annual American Water Resources Conference, Washington, DC, October 1971 (with B. J. Adams and R. S. Gemmell)

"Systems Analysis: Implications for Construction Management," Transactions of the American Association of Cost Engineers, 16th Annual Meeting, Liberty, New York, June 25-28, 1972

"Optimal Design of Urban Wastewater Collection Networks," Journal of the Sanitary Engineering Division, American Society of Civil Engineers, forthcoming (with R. S. Gemmell and E. K. Morlok)

"Optimization of Wastewater Collection Networks," Office of Water Resources Research, 1970-71

"Economics of Urban Wastewater Networks," 1970-date

Previous full-time professional experience: 4 yrs. (3 yrs. industry and 1 yr. consulting)

Member, American Society of Civil Engineers
Member, American Institute of Physics
Member, American Society of Planning Officials

ROBERT J. DRYE
Adjunct Assistant Professor
Department of Civil Engineering
1972

BS	North Carolina State College	Civil Engineering	1963
MS	North Carolina State University	-	1965
PhD	University of North Carolina-Chapel Hill	-	1970

100% (teaching)

"Stimulation of the Differential Rate of Enterotoxin B Synthesis by Components in Case in Hydrolysate," Bacteriological Proceedings 1969, 69th Annual Meeting of American Society for Metals, Miami Beach, Florida, May 1969 (with R. A. Mah)

"Influence of Nitrolotriacetate on Eutrophication in Situ and Batch Assays," Provisional Algal Assay Procedure FWQA Project Number 16010 DQT Interim Report transmitted to Project Office, National Eutrophication Research Program, Pacific Northwest Water Laboratory, Corvallis, Oregon, November 1970 (et al.)

"Ecology and the Dietician," presented to North Carolina Dietetics Association, Charlotte, North Carolina, March 1972

Previous full-time professional experience: 2 yrs. (government)

ALAN E. RIMER
Lecturer
Department of Civil Engineering
1972

BS	Duke University	Civil Engineering	1964
MS	University of North Carolina	Sanitary Engineering	1966

Sanitary engineering design, engineering economics, unit processes

100% (teaching)

"Microstraining Paper Mill Wastewater," Journal Water Pollution Control Federation, July 1971

"Filtration through a Trimedia Filter," Journal Sanitary Engineering Division, American Society of Civil Engineers, June 1968

"Paper Mill Wastewaters--A Prototype Study of Microstraining," presented at the 45th Annual Conference, Water Pollution Control Federation, October 1972

Registered professional engineer: North Carolina, New York, New Hampshire, and Vermont

Previous full-time professional experience: 7 yrs. (consulting)

Member, American Society of Civil Engineers
Member, American Water Works Association
Member, American Public Works Association

BRUCE J. MUGA
Associate Professor
Department of Civil Engineering
1967

BBA	Southern Methodist University	-	1950
BCE	University of Texas	Civil Engineering	1957
MS	University of Illinois	-	1961
PhD	University of Illinois	-	1966

Fluid mechanics, coastal hydraulics, hydrology

10% (teaching)

"Mechanics of Raising and Lowering Heavy Loads in the Ocean: Experimental Results," Technical Report R-543, US Naval Civil Engineering Laboratory, Port Hueneme, California, 1967

"Experimental Results of Lowering and Raising Heavy Loads in the Ocean," Proceedings of National Symposium on Ocean Sciences and Engineering of the Atlantic Shelf, Marine Technology Society, March 1968

Dynamic Analysis of Ocean Structures, Plenum Press, New York-London, 1970 (with J. F. Wilson)

Registered professional engineer: California

Previous full-time professional experience: 7 yrs. (4 yrs. industry and 3 yrs. consulting)

Member, American Society of Civil Engineers
Member, Research Engineering Society of America
Life member, Permanent International Association for Navigational Congresses

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DENNIS B. WARNER
Assistant Professor
Department of Civil Engineering
1973

BA	University of Illinois	History	1963
BSc	University of Illinois	Civil Engineering	1963
MSc	University of Illinois	Civil Engineering	1966
Degree of Engr.	Stanford University	Engineering Economic Planning	1968
PhD	Stanford University	Engineering Economic Planning	1973

Water resources, planning, water supplies, water and wastewater draining, engineering economics

100% (teaching)

"A Preliminary Assessment of the Impact of Rural Water Supply Upon Households and Villages," Ekistics, 31, 187, pp. 452-458, June 1971

"The Challenge to Civil Engineering," Civil Engineering, American Society of Civil Engineers, pp. 66-67, July 1972

"Engineering Aspects of Public Health Activities and Needs in Uganda," Public Health and Hygiene, forthcoming

Member, American Society of Civil Engineers
Member, East African Agricultural Economics Society
Member, Public Health Inspectors' Association (Uganda)

Students

		69-70 FT PT	70-71 FT PT	71-72 FT PT	72-73 FT PT	73-74 FT PT	
Civil Engineering	Master's	-	0	4	9	7	ENROLLMENT
(Envir. Engr.)	Doctoral	-	0	0	1	1	
Civil Engineering	Master's	-	0	0	12	8	GRADUATES
(Envir. Engr.)	Doctoral	-	0	0	0	0	
Civil Engineering	Master's	1	NON-US NATIONALS				
(Envir. Engr.)	Doctoral	1					

SUPPORT

	Master's	Doctoral
Internship	1	0
HUD fellowship	1	0
Graduate School	3	1
Self-supported	4	0

First students graduating 5-73

Ecole Polytechnique

Institution affiliated to the University of Montreal
Montreal, Province of Quebec, Canada

Civil Engineering
Ecole Polytechnique

Environmental Engineering

Faculté des Etudes Supérieures, Université de Montréal

Professor André Leclerc, Chairman
Section du Génie de l'Environnement
Ecole Polytechnique
2500, avenue Marie-Guyard
Montréal 250, Québec
(514) 344-4800

June 1973

The environmental engineering graduate program at Ecole Polytechnique is water oriented. The student can specialize in sanitary engineering, hydrology, or water resources. We offer the following degrees in environmental engineering: MScA, MIng, DScA.

Ecole Polytechnique is an engineering school with undergraduate and postgraduate programs. The enrollment is 1500 undergraduate engineering students and 250 postgraduate students. Ecole Polytechnique is located in Montreal on the University of Montreal campus. Tuition and fees for full-time graduate students average $600 for an academic year.

The University of Montreal is a French-speaking university; therefore, a practical knowledge of French is essential although reports and theses can be submitted in English.

Admission Requirements

(a) 2.5/4 for MIng and MScA; 3.0/4 for DScA.

(c) Conditional admission is possible for those who obtained their bachelor degree with 2.2/4. They can register for a Diploma of Complementary Studies. If they complete the Diploma with a high standing, they might ask for a transfer to a Master's Degree.

(d) A practical knowledge of French is essential since it is the teaching language. A reading knowledge of English is also desirable.

(e) Any engineering discipline at an accredited institution is acceptable. Normally, civil engineers and chemical engineers are accepted without any prerequisites. Also students with undergraduate degrees (BSc) in biology, biochemistry, and chemistry can register for a MScA degree.

(f) Nonengineers can be required to take some undergraduate courses such as sanitary engineering, hydrology, fluid mechanics, or computer programming.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MScA--Envir. Engr.	45	Yes	No	-	12
MIng--Envir. Engr.	45	No	No	-	12
DScA--Envir. Engr.	60	Yes	2	-	36

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
1.619	Hydrology	Leclerc Rousselle	3	-	6
1.620	Fluid Mechanics I	Gidas	5	-	4
1.6201	Fluid Mechanics II	Gidas	5	-	4
1.6203	Thermal Pollution	Robillard	4	-	6
1.6202	Flow through Porous Media	Gidas	3	-	3
1.6205	Applied Statistics to Water Resources	Rousselle	4	-	6
1.6221	Free Surface Flow	Kahawita	4	-	3
1.6223	Sediments Transport	Godin	3	-	5
1.6241	Theory of Waves	Partenscky	3	-	9
1.625	Environmental Microbiology	Drapeau	4	-	27
1.6271	Wastewater Treatment	Bois	6	-	22
1.6281	Environment	Drapeau & Guests	3	-	15
1.6282	Control of Industrial Atmos. Poll.	Plamondon	3	-	-
1.629	Theory of Water Chemistry	Briere	4	-	25
1.641	Hydrodynamics of Estuaries	Partenscky	3	-	-
1.626	Theory of Water Purification	Labonte	5	-	21
1.675	Water Treatment Plant Design	Perrault	5	-	-
1.676	Wastewater Treatment Plant Design	Labonte	6	-	16
1.680	Water Resources	Briere	4	-	10
1.690	Water Analysis	Bois	4	-	13

SP 620	Epidemiology	Nantel Charest	3	-	4
BIOL 320	Ecology of Fresh Waters	Harper	5	-	12

Faculty

ANDRÉ LECLERC
Professor and Head of Environmental Engineering Division
Civil Engineering Department
1947

BScA	Ecole Polytechnique	Mechanical Engineering	1944
MSc	State University of Iowa	Civil Engineering	1948

Physical processes such as filtration; hydraulics and hydrology

100% (40% teaching, 30% research, 30% administration)

Symposium on Wastewater Treatment for Small Municipalities, November 19-20, 1965 (ed.)

"Desorption and Retentivity of Filtering Materials," Journal Sanitary Engineering Division, American Society of Civil Engineers, SA6, December 1972 (with Truong Tri Vu)

"Charactéristiques Topographiques du Bassin Versant de la Rivière Eaton, Québec," Publication H.P. 5 du Ministère des Richesses Naturelles du Québec, 1964 (with Leonard Cartier)

"Filtration through Multi-Media Beds," National Research Council, 3/73-3/74, principal investigator

"Water Resources Study of a Typical Watershed," Ministry of Education of Québec, 1971-74, principal investigator

Registered professional engineer: Province of Québec, Canada

Previous full-time professional experience: 2 yrs. (industry)

Consultant, Cartier and Leclerc (consulting firm)
President, Quebec Section of American Water Works Association (1969)
Vice President, International Association for Hydraulic Research

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ROGER LABONTÉ
Professor
Civil Engineering Department
1957

BScA	Ecole Polytechnique	Civil Engineering	1955
DIC	Imperial College, London	Public Health Engineering	1956
San E	Massachusetts Institute of Technology	Sanitary Engineering	1962

Unit processes and wastewater treatment design, nitrogen and phosphorus removal from wastewater

100% (60% teaching, 30% research, 10% administration)

"A Procedure for Continuous Nitrification Correction during Warbug Respirometer Studies," Journal Water Pollution Control Federation, 37, June 1965 (with J. M. Symons)

"L'épuration des eaux usées," Le Québec laitier et alimentaire, March 1966

"Chemical Treatment for Nitrogen and Phosphorus Removal from Wastewaters," National Research Council of Canada

Registered professional engineer: Province of Québec, Canada

Previous full-time professional experience: 2 yrs. (government)

Advisor, Consulting Engineering Firms
Short-term consultant, World Health Organization

ARNOLD J. DRAPEAU
Professor
Civil Engineering Department
1967

BScA	Université Laval	Chemical Engineering	1954
DipBact	Toronto University	Microbiology	1960

Sanitary microbiology

100% (75% teaching, 25% research)

"L'écologie et l'homme," *Eau du Québec*, *6*, 1, pp. 15-25, March 1973 (with Francois Briere)

"Répertoire international de films 16 mm. sur les sciences de l'eau," Publication Number 100-1-72, 1972

"Probabilité et certitude du nombre le plus probable," *Eau du Québec*, *4*, 2, pp. 11-20, 1971

"Choix d'un équipement capable de déceler la présence d'entérovirus dans les eaux traitées," 1973

"Effet d'un micropolluant aquatique (pesticide) sur un biotope synthétique," 1970

"Influence du Sevin sur la croissance d'une algue d'étang d'oxydation," 1971

Registered professional engineer: Province of Quebec, Canada

Previous full-time professional experience: 13 yrs. (4 yrs. industry and 9 yrs. government)

Member, Board of Governors of the First International Film Festival on the Human Environment
Member, International Joint Commission Research Advisory Board
Member, "Centre de recherche de l'Ecole Polytechnique de Montréal"

LUC BOIS
Associate Professor
Civil Engineering Department
1961

BScA	Université Laval	Chemical Engineering	1954
SM	Massachusetts Institute of Technology	Sanitary Engineering	1956

Water analysis, sanitary chemistry, water and sewage treatment, industrial wastes

100% (75% teaching, 15% research, 10% administration)

"L'Examen des eaux usées en laboratoire," *Revue l'Ingénieur*, September 1970

"Improvement in Oxygenation Capacity of an Aerator Following Design Modifications," Ecole Polytechnique, 1972

"Phosphorus Removal Obtained in a Pilot Plant for Lime Treatment of Raw Sewage," Canadair Limited, 1972

Registered professional engineer: Province of Québec, Canada

Previous full-time professional experience: 7 yrs. (4 yrs. government and 3 yrs. consulting)

Member, Association Québecoise des Techniques de l'Eau
Member, Canadian Institute on Pollution Control
Short-term consultant, World Health Organization in Africa (1971)
Consultant, engineering firms and municipalities in Québec

ALEXANDRE GODIN
Associate Professor
Civil Engineering Department
1959

BScA	Ecole Polytechnique	Mechanical Engineering	1956
MScA	Ecole Polytechnique	Civil Engineering	1966
DEA	Université de Toulouse	Hydraulics	1968

Fluid mechanics, applied hydraulics, pumps, hydraulics transients

100% (75% teaching, 25% research)

"Systematic Study of Orifices for Surge Chambers," two reports submitted to National Research Council of Canada, 1968

"Model Investigations for the Gabbro Control Structure of the Churchill Falls Power Project, Labrador," Acres Canadian Bechtel of Churchill Falls, 1970

"Erosion Tests on Samples of Clay from Rupert 1 Site, James Bay," Quebec Hydro, 1971

"Model Investigations for Laniel Control Structure," Quebec Hydro, 1971

Registered professional engineer: Province of Québec, Canada

Previous full-time professional experience: 3 yrs. (industry)

Consultant, World Health Organization, Rabat, Morocco (1971)
Consultant, companies involved in the design of pumping stations and flow-measuring instruments

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LUC ROBILLARD
Associate Professor
Civil Engineering Department
1966

BScA	Ecole Polytechnique	Civil Engineering	1963
SM	Massachusetts Institute of Technology	Hydraulics	1965
HydrE	Massachusetts Institute of Technology	Hydraulics	1966

Fluid mechanics of pollution, specially stratified flow, diffusion processes, thermal pollution, hydraulics

100% (75% teaching, 25% research)

"Mouvement périodique d'un jet bidimensionnel plan et production de tourbillons alternés," *Journal de Mécanique*, *10*, 1, pp. 113-131, March 1971

"Some Experimental Observations on Free Surface Flow over a Wavy Bed," *Proceedings*, 12th Congress International Association for Hydraulic Research, 1967 (with L. Robillard and J. F. Kennedy)

"Unstable Characteristics of a Plane Counter Jet," CANCAM, Calgary, pp. 569-570 (*et al.*)

"Jet Diffusion in a Free Surface Flow of Different Densities"

Registered professional engineer: Province of Québec, Canada

FRANCOIS BRIÈRE
Assistant Professor
Civil Engineering
1966

BScA	Ecole Polytechnique	Civil Engineering	1963
MScA	Ecole Polytechnique	Sanitary Engineering	1964
MEng	Harvard University	Water Resources	1971

Water resources and water chemistry

100% (75% teaching, 25% research)

"Prédiction du rendement maximal de systèmes d'aération par diffusion d'air," La Technique de l'Eau et de l'Assainissement, 304, pp. 19-25, March 1972 (with A. Benzina)

"Optimisation du rendement maximum de systèmes d'aération par diffusion d'air," La Tribune du CEBEDEAU, 342, pp. 270-276, May 1972 (with A. Benzina)

"Optimisation des périodes de calcul pour les usines de traitement d'eau," Eau du Quebec, 5, 2, pp. 37-39, May-June 1972

"Use of Inert Tracer Data to Estimate the Course of Reaction in Geometrically Complex Natural Flows," Advances in Chemistry, Series 106 (with L. A. Spielman)

Registered professional engineer: Province of Québec, Canada

Previous full-time professional experience: 3 yrs. (government)

Consultant, Degremont Company
Consultant, Federal Government
Consultant, Provincial Government
Consultant, Canadair Company
President of environmental protection agency, Québec Wildlife Federation

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JEAN ROUSSELLE
Assistant Professor
Civil Engineering Department
1964

BScA	Ecole Polytechnique	Civil Engineering	1962
MScA	Ecole Polytechnique	Hydraulics	1968
PhD	Colorado State University	Hydrology	1972

Hydrology, water resources

100% (75% teaching, 25% research)

"Some Problems of Flood Analysis," Water Resources Research, 7, 5, 1971 (with P. Todorovic)

"A Stochastic Model for Flood Analysis," presented in the American Geophysical Union Section of Hydrology Program at the Fall National Meeting in San Francisco, December 4-7, 1972

"Stochastic Model for Flood Analysis," National Research Council of Canada, 4/72-3/75, principal investigator

"Water Resources Study Applied to the North River Watershed," Ministry of Education, 7/71-4/74, co-investigator

Registered professional engineer: Province of Québec, Canada

Previous full-time professional experience: 2 1/2 yrs. (government)

Students

		68-69	69-70	70-71	71-72	72-73	
		FT PT	FT PT	FT PT	FT PT	FT PT	
Environmental Engineering	Master's	10	10	7	7	21	ENROLLMENT
	Doctoral	1	1	1	2	0	
Environmental Engineering	Master's	10	10	7	6	20	GRADUATES
	Doctoral	0	0	0	0	1	
Environmental Engineering	Master's	7	NON-CANADIAN STUDENTS				
	Doctoral	3					

Facilities

The sanitary chemistry and microbiology laboratories (1500 sq ft) and the unit processes laboratory (approximately 500 sq ft) are well equipped for all types of determinations and studies on water, sewage, and industrial wastes.

Ecole Polytechnique has its own library and is currently stocked with about 150,000 volumes and 1800 periodical titles. The Ecole Polytechnique Computer Center is available for student use. Our location on the University of Montreal campus makes possible access to the facilities of other faculties for interdisciplinary programs.

University of Florida

Gainesville, Florida

Environmental Engineering Sciences Department
College of Engineering

Environmental Engineering
Environmental Sciences

ECPD Accredited--Environmental Engineering

Dr. Edwin E. Pyatt, Professor and Chairman
Environmental Engineering Sciences Department
217 A. P. Black Hall
University of Florida
Gainesville, FL 32611
(904) 392-0841

February 1974

Two distinct programs are available to graduate students in the Department of Environmental Engineering Sciences depending upon their educational background and professional goals. A program in environmental sciences is available to students possessing undergraduate degrees in engineering or a basic science. Persons with degrees in a nontechnical field may also be admitted into this program upon completion of specified articulation work. Direct admission into the environmental engineering program requires that a student be a graduate engineer. Other persons wishing to enter this program will be required to take articulation work sufficient to bring their backgrounds into substantial agreement with those with undergraduate engineering training.

In view of the pace of progress and the demands which have been placed upon environmentalists, the University of Florida seeks to provide both breadth in traditional environmental engineering and depth in the engineering and scientific aspects of several areas of specialization. By providing the flexibility of nine major course programs, graduates are well prepared for their specific career objectives. The areas of concentration in the Department of Environmental Engineering Sciences are: water supply and water pollution control, air pollution, radiological health, environmental resources management, environmental biology, environmental chemistry, solid wastes and systems ecology.

The University of Florida is a combined state university and land-grant college dating from 1853. The enrollment is about 24,000, making it the largest university in the southeast. Five departments in the College of Engineering gained buildings valued at over $1 million each in 1967.

The University of Florida is unique among institutions of higher education in the southeast in having upon one campus colleges of agriculture, arts and sciences, engineering, law, medicine, and nine others. These colleges contribute significantly to the education of graduate students in areas related to environmental engineering sciences.

The University spreads over 2,000 acres in Gainesville where a red brick motif bonds Gothic to modern architecture on spacious lawns studded with palm and pine trees. Social and cultural activities are abundant and varied. The sportsman may enjoy some of the finest recreational facilities in the nation.

Admission Requirements

(a) 3.0/4 GPA required.

(b) GRE of 1100 is required for the departmental minimum and 1000 for the Graduate School minimum (verbal and quantitative combined). No advanced test is required.

(c) Conditional admission is possible if the student does not meet minimum GPA or GRE standards with approval of the Faculty Admissions Committee of the department.

(d) A minimum score of 550 on the TOEFL language examination for foreign students is required.

(e) Any undergraduate basic science discipline is normally acceptable for admission to the program(s). Others may be admitted if articulation work in the sciences is taken.

(f) Any student admitted may pursue an MS degree directly. Nonengineers who wish to obtain an ME degree must take approximately one year of undergraduate engineering courses as articulation work.

(g) Three letters of recommendation are required for all applicants.

(h) The formal requirements for admission to the graduate program are the same for Master's and doctoral applicants; however, the Faculty Admissions Committee is much more selective for the PhD applicants.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	[a]	Optional	No	12 mos.	12
ME--Envir. Engr.	[a]	Optional	No	12 mos.	12
Engineer Degree--Envir. Engr.	45Q	No	No	9 mos.	9
PhD--Envir. Engr.	varies	Yes	1	90Q[b]	24[c]

[a] With thesis option 36Q (+9 thesis) and with nonthesis option 54Q.

[b] Beyond Bachelor's Degree.

[c] Beyond Master's Degree.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
ENE 201	Concepts of Envir. Engr. Science	Boley & Bayley	2Q	NEW'73	-
ENE 301	Environmental Quality & Man	Bevis	4Q	W'73	35
ENE 401	Environmental Engr. Sciences	Staff	4Q	NEW'73	-
ENE 500	Treatment of Wastewater	Zoltek	4Q	W'73	9
ENE 520	Environmental Biology	Fox	4Q	F'72	18
ENE 522	Public Health Engineering	Bevis	3Q	W'73	15
ENE 531	Water & Wastewater Analysis	Brezonik	4Q	F'72	17
ENE 534	The Chemistry of Water Treatment	Singley	5Q	W'73	10
ENE 540	Intro. to Radiological Health	Bevis	3Q	F'72	18

ENE 551	Intro. to Air Pollution	Urone	3Q	F'72	24
ENE 560	Ecological & General Systems	Odum	4Q	F'72	26
ENE 561	Ecological Engineering Seminar	Odum	2Q	NEW'73	-
ENE 580	Intro. to Solid Wastes	Furman	3Q	W'73	10
ENE 591	Special Topics in Envir. Engr. 1	Staff	1-5Q	W'73	2
ENE 592	Special Topics in Envir. Engr. 2	Staff	1-5Q	W'73	2
ENE 600	Adv. Waste Treatment Operations	Zoltek	5Q	F'72	8
ENE 601	Adv. Envir. Engr. Design 1	Furman	5Q	F'72	6
ENE 602	Adv. Envir. Engr. Design 2	Hudson	5Q	S'70	5
ENE 611	Water Quality Management	Pyatt	4Q	W'73	10
ENE 612	Water Management Seminar	Heaney	4Q	S'70	3
ENE 613	Envir. Resource Systems	Heaney	4Q	F'72	6
ENE 616	Urban Environmental Problems	Heaney	4Q	S'72	23
ENE 617	Estuarine Systems	Odum	4Q	W'73	27
ENE 618	Pollution Transport Systems	Huber	4Q	W'73	14
EGC 621	Surface Hydrology	Huber	4Q	F'72	15
EGC 622	Operational Hydrology 1	Huber	4Q	W'72	6
EGC 623	Operational Hydrology 2	Huber	4Q	S'72	6
ENE 626	Aquatic Microbiology	Staff	4Q	W'72	16
ENE 627	Biology of Aquatic Systems	Fox	4Q	S'72	9
ENE 630	Environmental Chemistry	Singley	5Q	W'73	20
ENE 631	Advanced Water Analysis	Brezonik	4Q	W'73	10
ENE 636	Principles of Water Chemistry	Singley Brezonik	5Q	W'73	10
ENE 641	Radiological Techniques	Bolch	5Q	W'72	8
ENE 642	Radioactive Wastes	Bolch	4Q	F'72	15
ENE 643	Electronic Product Radiation	Bolch	4Q	F'72	15
ENE 644	Health Physics	Roessler	4Q	W'73	11
ENE 650	Occupational Health	Staff	4Q	F'71	9
ENE 652	Environmental Instrumentation	Staff	5Q	S'70	5
ENE 654	Air Pollution Sampling & Analysis	Urone	4Q	W'73	14
ENE 655	Air Pollution Control Measures	Staff	4Q	S'72	22
ENE 656	Environmental Meteorology	Huber	4Q	F'72	19
ENE 657	Environmental Micrometeorology	Staff	4Q	S'70	4
ENE 668	Man & His Environment	Hoadley	5Q	F'72	22
ENE 670	Graduate Envir. Engr. Seminar	Staff	0-2Q	W'73	54
ENE 671	Special Problems in Envir. Engr. 1	Staff	1-5Q	F'73	56
ENE 697	Supervised Research	Staff	1-5Q	F'72	1
ENE 699	Master's Research	Staff	1-17Q	W'73	15
ENE 799	Doctoral Research	Staff	1-17Q	W'73	21
CE 628	Hydraulics of Stratified Flow	Huber	3Q	Su'71	6
STA 602	Statistical Methods in Research 1	Scheaffer	4Q	W'73	61

ENE 520, 630, STA 602 and ISE 350 are required of all students unless thay have completed equivalent courses.

Faculty

EDWIN E. PYATT
Professor and Chairman
Environmental Engineering Sciences Department
1965

BS	California Institute of Technology	Engineering	1951
MS	University of California-Berkeley	Sanitary Engineering	1953
DrEng	Johns Hopkins University	Sanitary Engineering	1959

Water quality management

100% (20% teaching, 10% research, 70% administration)

"On Estimating Benefit-Cost Ratios for Water Supply Investments," American Journal of Public Health, 52, 10, 1962 (with P. P. Rogers)

"Benefit-Cost Analysis for Municipal Water Supplies," Land Economics, XL, 4, 1964 (with P. P. Rogers and H. Sheikh)

"Simulation Model for Flow Augmentation Costs," Journal Hydraulics Division, American Society of Civil Engineers, January 1970 (with A. I. Perez and J. C. Schaake)

"Model for Flow Augmentation Analysis--An Overview," Journal Sanitary Engineering Division, American Society of Civil Engineers, October 1970 (et al.)

"Costs for Equivalent Upstream Reduction in Waste Water Discharges," Water Resources Research, June 1971 (with J. P. Heaney and B. J. Carter)

"Water Pollution Control Training Grant," Environmental Protection Agency, 7/71-8/77, principal investigator

"A Decision-Making Model for the Management of Storm Water Pollution Control," City of Lancaster, Pennsylvania, 6/71-6/73, co-investigator

"Rational Floodplain Management," National Science Foundation, 9/71-8/73, principal investigator

Registered professional engineer: California, Illinois, and Connecticut

Previous full-time professional experience: 9 yrs. (4 yrs. academic, 2 yrs. research and development, 3 yrs. government)

Member, American Society of Civil Engineers; Member, National Committee on the Sanitary Engineering Aspects of Water Resources (1965-71); Program Chairman, Gainesville Branch (1967); Vice President, Gainesville Branch (1968); President, Gainesville Branch (1969); Member, Board of Directors, Florida Section (1969)
Member, Water Pollution Control Federation
Member, American Water Works Association; Member, National Committee on Water Rates (1964-65)
Member, American Public Health Association
Member, American Society for Engineering Education

SUZANNE E. BAYLEY
Assistant Professor
Environmental Engineering Sciences Department
1973

BS	Washington College	Biology	1963
PhD	Johns Hopkins University	Ecology	1970

Aquatic ecology

100% (25% teaching, 75% research)

"Models for Planning and Research for the South Florida Environment Study," mimeo report for US Department of the Interior, 1971 (et al.)

"Recent Decline in the Distribution and Abundance of Eurasian Milfoil in Chesapeake Bay," Chesapeake Science, 9, 3, 1968 (with H. Rabin and C. H. Southwick)

"Simulation of a Model of Sawgrass Marsh with Peat, Fire, Water and Phosphorus," presented at 35th Annual Meeting of the American Society of Limnology and Oceanography (abstract), 1972 (with H. T. Odum)

"Simulation of Macroenergetic Models of Environment, Power and Society," Atomic Energy Commission, 9/72-9/73, co-investigator

"Continuation of an Evaluation of Water Management Alternatives in the Upper St. Johns River Basin," Florida Department of Natural Resources, 1/73-5/73, principal investigator

Previous full-time professional experience: 4 yrs. (1 yr. academic and 3 yrs. research and development)

Member, Atlantic Estuarine Society
Member, General Systems Society
Member, American Association for the Advancement of Science
Member, Ecological Society of America

HERBERT A. BEVIS
Associate Professor
Environmental Engineering Sciences Department
1961

BCE	University of Florida	Public Health	1951
MSE	University of Florida	Sanitary Engineering	1952
MS	Naval Postgraduate School	Physics	1958
PhD	University of Florida	Sanitary Engineering	1963

Health physics, environmental radiation surveillance

100% (40% teaching, 60% administration)

"Inhaled Ozone as a Mutagen--I. Chromosome Aberrations Induced in Chinese Hamster Lymphocytes," *Environmental Research*, 4, 4, 1971 (*et al.*)

"Inhaled Ozone as a Mutagen--II. Effect on the Frequency of Chromosome Aberrations Observed in Irradiated Chinese Hamsters," *Environmental Research*, 4, 4, 1971 (*et al.*)

"Low Temperature Adsorption and Gamma Scintillation Spectrometry for Measuring Argon-41," *International Journal of Applied Radiation and Isotopes*, 16, 9, 1965 (with B. G. Dunavant)

"Significance of Radioactivity in Water Supply and Treatment," *Journal American Water Works Association*, 52, 7, 1960

"Investigations of Unusual Cesium Ecology in Florida--Cesium-137 Levels in Feed-Lot Beef," *Health Physics*, 16, 1969 (with C. E. Roessler and B. G. Dunavant)

"Radiological Health Specialist Training Grant," Environmental Protection Agency, 7/68-6/73, principal investigator

Registered professional engineer: Florida and Texas

Previous full-time professional experience: 9 yrs. (4 yrs. research and development, 3 yrs. government, 2 yrs. industry)

Diplomate, AAEE
Member, National Society of Professional Engineers
Member, Florida Engineering Society
Member, American Society of Civil Engineers
Member, Health Physics Society
Member, American Public Health Association

GABRIEL BITTON
Assistant Professor
Environmental Engineering Sciences Department
1974

Eng Degree	Toulouse University (France)	Agronomy	1965
BS	E. N. S. A. T.	Biology	1965
MS	Laval University (Canada)	Soil Science	1967
PhD	Hebrew University (Israel)	Microbial Ecology	1972

Microbiology

100% (50% teaching, 50% research)

"Influence de la Matiere Organique dans le Dosage du Fer, de l'aluminium et du Manganese dans les Sols a l'aide du Spectrophotometre a Absorption Atomique," *Le Naturaliste Canadien*, 96, 1969 (with R. Baril)

"Use of Montmorillonite for the Demonstration of Capsules of *Klebsiella aerogenes* and Corynebacterium sp.," *Applied Microbiology*, 22, 1971 (with Y. Henis)

"Effect of Several Clay Minerals and Humic Acid on the Survival of *Klebsielle aerogenes* Exposed to Ultra-Violet Irradiation," *Applied Microbiology*, 23, 1972 (with Y. Henis and N. Lahav)

Previous full-time professional experience: 3 yrs. (academic)

Member, Association Des Ingenieurs Anciens Eleves De L'E. N. S. A. T.
Member, Association Canadienne Pour L'Avancement Des Sciences (ACFAS)
Member, American Society for Microbiology

W. EMMETT BOLCH
Associate Professor
Environmental Engineering Sciences Department
1966

BSCE	University of Texas-Austin	Civil Engineering	1959
MSEHE	University of Texas-Austin	Environmental Health Engineering	1964
PhD	University of California-Berkeley	-	1967

Radiological techniques, environmental monitoring

100% (50% teaching, 50% research)

"A Utility Sponsored Environmental Surveillance and Radioecological Research Program for a Coastal Nuclear Power Plant," American Journal of Public Health, 62, 1972 (et al.)

"Development and Comparison of Compton Suppression Techniques for Low-Level Radionuclide Analysis," Proceedings, The Institute of Electrical and Electronics Engineers, Inc. 1972 Nuclear Science Symposium, Miami, Florida, 1972 (et al.)

"An Ecological Approach to Environemntal Surveillance," Proceedings, 5th Annual Midyear Topical Symposium, Health Physics Society, Idaho Falls, Idaho, 1970 (et al.)

"Inhaled Ozone as a Mutagen--II. Effect on the Frequency of Chromosome Aberrations Observed in Irradiated Chinese Hamsters," Environmental Research, 4, 4, 1971 (et al.)

"Environmental Surveillance for Radioactivity in the Vicinity of the Crystal River Nuclear Power Plant; An Ecological Approach," Environmental Status Reports, Florida Power Corporation (published quarterly since December 1970), 1971

"Environmental Health Aspects of Cesium-137 and Other Radionuclides in the Florida Environment," US Atomic Energy Commission, 5/67-5/69, co-investigator

"Environmental Surveillance for Radioactivity in the Vicinity of the Crystal River Nuclear Power Plant: An Ecological Approach," Florida Power Corporation, 8/70-7/74, principal investigator

"Trace Element Analysis in Complex Environmental Samples," Division of Sponsored Research, University of Florida, 12/72-11/73, co-investigator

Registered professional engineer: Florida

Previous full-time professional experience: 4 yrs. (government)

Member, Florida Chapter of the Health Physics Society; Editor of Newsletter (1969-70); President-Elect (1970); President (1971); Executive Council (1972); Committee on Revision of By-Laws (1972)
Member, Florida Engineering Society; Chairman of Engineers' Week (1971)
Member, American Public Health Association
Member, International Radiation Protection Association
Member, Tau Beta Pi

PATRICK L. BREZONIK
Associate Professor
Environmental Engineering Sciences Department
1966

BS	Marquette University	Water Chemistry	1963
MS	University of Wisconsin	Water Chemistry	1965
PhD	University of Wisconsin	Water Chemistry	1968

Water chemistry, chemical limnology, eutrophication

100% (40% teaching, 60% research)

"Relationships between Trophic State and N and P Loading Rates," Environmental Science Technology, 6, 1972 (with E. E. Shannon)

"Eutrophication Analysis: A Multi-Variate Approach," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, 1972 (with E. E. Shannon)

"Nitrogen Fixation in Lake Mize, Florida, and in Some Lacustrine Sediments," Limnology, Oceanography, 16, 1971 (with M. A. Keirn)

"Measurement of ATP and Its Application in Biological Waste Treatment," Environmental Science Technology, 4, 1970 (with J. W. Patterson and H. D. Putnam)

"Kinetics and Dynamics in Natural Water Systems," in Water and Water Pollution Handbook (L. L. Ciaccio, ed.), 3, Marcel Dekker, New York

"Eutrophication Factors in North Central Florida Lakes," Environmental Protection Agency, 1967-70, co-investigator

"Lake Drawdown--A Method of Improving Water Quality," Environmental Protection Agency, 5/72-4/74, co-investigator

"Data Acquisition and Management for Water Quality Control," National Science Foundation, 1972-74, co-investigator

Member, American Chemical Society
Member, American Association for the Advancement of Science
Member, American Society of Limnology and Oceanography
Member, Florida Pollution Control Association

JACKSON L. FOX
Assistant Professor
Environmental Engineering Sciences Department
1968

BS	Bucknell University	Biology	1961
MPH	University of Minnesota	Public Health	1965
PhD	University of Minnesota	Public Health Biology-Environmental Health	1969

Limnology, public health biology, eutrophication

100% (50% teaching, 50% research)

"Some Effects of a Power Plant on Marine Microbiota," Chesapeake Science, 14, 1, 1973 (co-author)

"The Collection, Identification and Quantitation of the Epilithic Periphyton of Lake Superior," Proceedings, 10th Conference on Great Lakes Research, 1967 (co-author)

"The Ecology of Periphyton in Western Lake Superior I. Taxonomy and Distribution," Water Resources Research Center, University of Minnesota Graduate School Bulletin 14, 1969 (co-author)

"Lake Drawdown--A Method of Improving Water Quality," Environmental Protection Agency, 5/72-4/74, principal investigator

"Guatemalan Lake Study," Biomedical Sciences, 1969-70, co-investigator

"Power Plant Effects," Florida Power Corporation, 1971, principal investigator

Previous full-time professional experience: 2 yrs. (government)

Member, American Association for the Advancement of Science
Member, Florida Academy of Science
Member, American Association of Limnology and Oceanography
Member, Water Pollution Control Federation
Member, Sigma Xi

T. deS. FURMAN
Professor
Environmental Engineering Sciences Department
1951

BS	The Citadel	Civil Engineering	1939
MSE	University of Florida	Sanitary Engineering	1950

Waste treatment design, solid waste management

100% (90% teaching, 10% research)

"Sewerage Planning," Florida Engineering Series No. 2, Engineering and Industrial Experiment Station, 1956 (co-author)

"Water Consumption by Institutions," Journal American Water Works Association, 53, 9, 1961 (co-author)

"Pilot Plant Treatment of Citrus and Domestic Waste," Proceedings of the Industrial Waste Workshop, September 1963, Florida State Board of Health, Jacksonville, Florida, 1963

"Existing Design Criteria for Wastewater Treatment Facilities," Proceedings of the Environmental Short Course at Winter Park, Florida, Engineers in Government, Florida Engineering Society, 1972

"Specialty Registration for Engineers," Civil Engineer, American Society of Civil Engineers, 1972

"Biological Removal of Nitrogen and Phosphorus from Waste Water Treatment Plant Effluent," Special Project, Engineering and Industrial Experiment Station, 7/72-6/74, principal investigator

"Evaluation of Ozone Generator," General Environmental Equipment Company, Inc., 2/73-4/73, principal investigator

Registered professional engineer: Florida and South Carolina

Previous full-time professional experience: 11 yrs. (4 yrs. government, 7 yrs. industry)

Diplomate, AAEE
Member, National Society of Professional Engineers
Member, Florida Pollution Control Association
Member, Water Pollution Control Federation
Fellow, American Society of Civil Engineers, Florida Engineering Society

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JAMES P. HEANEY
Associate Professor
Environmental Engineering Sciences Department
1968

BSCE	Illinois Institute of Technology	Civil Engineering	1962
MSCE	Northwestern University	Civil Engineering	1965
PhD	Northwestern University	Civil Engineering	1968

Mathematical programming, environmental systems

100% (50% teaching, 50% research)

"Equivalent Prices for Upstream BOD Removal," Water Resources Research, 1, 3, 1971 (with B. J. Carter and E. E. Pyatt)

"Optimal Atmospheric Emission Control in the Wood Pulp Industry," Atmospheric Environment, 5, 1971 (with L. C. Doughty)

"Model for Flow Augmentation Analysis--An Overview," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, SA5, 1970 (et al.)

"Source Control of Urban Water Pollution," Journal Water Pollution Control Federation, 1, 4, 1971 (with R. H. Sullivan)

"Water Resources and Social Choices," Water Resources Bulletin, 9, 1973 (with R. Burke and E. E. Pyatt)

"Socio-Economic Studies of the Upper St. Johns River Basin, Central and Southern Florida Flood Control Project," US Army Corps of Engineers, Jacksonville District, 9/72-3/74, principal investigator

"Data Acquisition and Management for Water Quality Control," National Science Foundation, 6/72-11/73, co-investigator

"A Decision-Making Model for the Management of Storm Water Pollution Control," City of Lancaster, Pennsylvania, 6/71-6/73, co-investigator

Previous full-time professional experience: 3 yrs. (government)

Member, American Geophysical Union
Member, American Society of Civil Engineers
Member, Operations Research Society of America
Member, The Institute of Management Science
Member, American Society for Engineering Education

WAYNE C. HUBER
Associate Professor
Environmental Engineering Sciences Department
1968

BS	California Institute of Technology	Engineering	1963
MS	Massachusetts Institute of Technology	Civil Engineering	1965
PhD	Massachusetts Institute of Technology	Civil Engineering	1968

Hydrodynamics, water resources

100% (50% teaching, 50% research)

"Temperature Prediction in Stratified Reservoirs," Journal Hydraulics Division, American Society of Civil Engineers, 98, HY4, 1972 (with D. R. F. Harleman and P. J. Ryan)

"Water Quality Model for a Conjunctive Surface-Groundwater System," Water Resources Bulletin, 8, 5, 1972 (et al.)

"An Environmental Evaluation of the Gordon River of Naples, Florida and the Impact of Developed Plans," Report to the County Commissioners, Collier County, Florida, 1972 (with H. T. Odum and C. Littlejohn)

"Routing Model for Combined Sewage," American Society of Civil Engineers National Water Resources Engineering Meeting, Memphis, Tennessee, Preprint No. 1108, 1970 (with L. W. Russell and E. E. Pyatt)

"A Data Collection Strategy for Lake Turbulence Measurements," presented at Fall Annual Meeting of American Geophysical Union, San Francisco, Paper No. H52, 1972 (with J. A. Steinberg)

"Determination of Vertical Diffusion Coefficients in Lakes," National Science Foundation and Environmental Protection Agency, 7/71-12/72, principal investigator

"Data Acquisition and Management for Water Quality Control," National Science Foundation, 6/72-11/73, principal investigator

"Socio-Economic Studies of the Upper St. Johns River Basin, Central and Southern Florida Flood Control Project," US Army Corps of Engineers, Jacksonville District, 9/72-3/74, co-investigator

Registered professional engineer: Florida

Associate Member, American Society of Civil Engineers
Member, American Geophysical Union
Member, International Association for Hydraulic Research
Member, American Water Resources Association
Member, Chi Epsilon

DALE A. LUNDGREN
Associate Professor
Environmental Engineering Sciences Department
1972

BS	University of Minnesota	Mechanical Engineering	1958
MS	University of Minnesota	Mechanical Engineering	1962
PhD	University of Minnesota	Environmental Health	1973

Aerosol dynamics and mechanics, air pollution control systems, occupational health

100% (50% teaching, 50% research)

"Mass Distribution Data from the 1969 Pasadena Smog Experiment," Journal of Colloid and Interface Science, 39, 1, 1972

"Venturi Scrubber Performance," Journal Air Pollution Control Association, 22, 7, 1972

"Application of a Light-Scattering Aerosol Counter and a Four-State Impactor to Industrial Hygiene Air Sampling," American Industrial Hygiene Association Journal, 32, 1, 1971

"Effects of Humidity on Light-Scattering Methods of Measuring Particle Concentration," Journal Air Pollution Control Association, 19, 4, 1969

"Aerosol Sampling with a Side Port Probe," American Industrial Hygiene Association Journal, 28, 3, 1967

"Evaluation of Ozone Generator," General Environmental Equipment Company, Inc., 2/73-4/73, co-investigator

Previous full-time professional experience: 10 yrs. (3 yrs. academic, 3 yrs. research and development, and 4 yrs. industry)

Member, Air Pollution Control Association
Member, American Industrial Hygiene Association
Member, American Society of Mechanical Engineering
Member, National Society of Professional Engineers
Member, American Chemical Society, Division of Water, Air and Waste Chemistry

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HOWARD T. ODUM
Graduate Research Professor
Environmental Engineering Sciences Department
1970

AB	University of North Carolina	-	1947
PhD	Yale University	Zoology	1951

Systems ecology, oceanography

100% (50% teaching, 50% research)

Environment, Power and Society, John Wiley and Sons, 1971

A Tropical Rain Forest, Division of Technical Information, US Atomic Energy Commission, 1970 (with R. F. Pigeon)

"Chemical Cycles with Energy Circuit Models," in The Changing Chemistry of the Oceans, Nobel Symposium, 20, John Wiley, New York, 1972

"The Use of Energy Diagrams for Environmental Impact Statements," in Tools for Coastal Management, Proceedings of the Conference on Marine Technology, Washington, DC, 1972

"Coastal Ecological Systems of the United States," Report to Federal Water Pollution Control Administration, 3, 1969 (with B. J. Copeland and E. A. McMahan)

"Evaluation of the Marine Ecosystem Developing within and Adjacent to the Thermal Plume of the Power Generation Units at Crystal River, Florida (Part II)," Florida Power Corporation, 5/72-5/73, principal investigator

"Simulation of the Response of Mangrove Swamps to Herbicides and Subsequent Recovery," National Research Council, 3/72-8/73, principal investigator

"Simulation of Macroenergetic Models of Environment, Power and Society," Atomic Energy Commission, 9/72-9/73, principal investigator

Previous full-time professional experience: 20 yrs. (10 yrs. academic, 10 yrs. research and development)

Professional Member, American Meteorological Society
Member, American Association for the Advancement of Science
Member, American Institute of Biological Science
Member, Ecological Society of America
Member, International Society of Tropical Ecology

CHARLES E. ROESSLER
Associate Professor
Environmental Engineering Sciences Department
1967

AB	Mankato State College	Biology/Chemistry	1955
MS	University of Rochester	Radiation Biology	1956
MPH	University of Pittsburgh	Occupational Health	1959
PhD	University of Florida	Environmental Engineering	1967

Health physics and radiation protection, environmental radioactivity studies, radioisotope techniques

100% (50% teaching, 50% research)

"A Utility-Sponsored Environmental Surveillance and Radioecological Research Program for a Coastal Nuclear Power Plant," American Journal of Public Health, 62, 10, 1972 (et al.)

"Unusual Behavior of Cesium in the Florida Biosphere," Quarterly Journal, Florida Academy of Science, 32, 1, 1969 (with G. S. Roessler and B. G. Dunavant)

"Cesium-137 Body Burdens in Florida Residents," Health Physics, 16, 1969 (with G. S. Roessler and B. G. Dunavant)

"Investigations of Unusual Cesium Ecology in Florida--Cesium-137 Levels in Feed-Lot Beef," Health Physics, 16, 1969 (with B. G. Dunavant and H. A. Bevis)

"Cesium-137 and Strontium-90 in Florida Milk--A Five-Year Study of Distributions and Levels," Health Physics, 16, 1969 (with E. G. Williams and E. D. Nettles)

"Environmental Surveillance for Radioactivity in the Vicinity of the Crystal River Nuclear Power Plant: An Ecological Approach," Florida Power Corporation, 8/70-7/74, co-investigator

Registered health physicist: American Board of Health Physics

Previous full-time professional experience: 7 yrs. (6 yrs. government, 1 yr. research and development)

Charter Member, Health Physics Society; Charter Member and President (1969), Florida Chapter
Member, American Public Health Association
Member, American Association for the Advancement of Science
Member, American Industrial Hygiene Association
Member, American Conference of Governmental Industrial Hygienists

J. EDWARD SINGLEY
Professor
Environmental Engineering Sciences Department
1967

BS	Georgia Institute of Technology	Chemistry	1950
MS	Georgia Institute of Technology	Chemistry	1952
PhD	University of Florida	Water Chemistry	1966

Water chemistry, potable water treatment, coagulation

100% (60% teaching, 40% research)

"Magnesium Carbonate--A Recycled Coagulant, I and II," Journal of American Water Works Association, 64, 93, 1972 (with C. G. Thompson and A. P. Black)

"Stoichiometry of the Coagulation of Organic Color-Causing Compounds with Ferric Sulfate," Journal American Water Works Association, 55, 1963 (et al.)

"Hydrolysis Products of Iron (III)," Journal of American Water Works Association, 1967 (with A. P. Black)

"Chemical Indicators of Fecal Pollution," Proceedings of XII Inter-American Congress of Sanitary Engineering, Caracas, Venezuela, 1970

"Chemical and Physical Purification of Water and Waste Water," Water and Water Pollution Handbook, New York, 1971

"Chemical Indicators of Fecal Pollution," Environmental Protection Agency, 6/71-12/72, principal investigator

"Cooperative Study of Air and Stream Improvement," National Council for Air and Stream Improvement, 7/67-6/73 (renewed annually), principal investigator

Previous full-time professional experience: 13 yrs. (industry)

Member, American Water Works Association
Member, American Institute of Chemists
Chairman-Elect, Gainesville Subsection, American Chemical Society (1972-73)
Member, Sigma Xi
Member, Tau Beta Pi

PAUL URONE
Professor
Environmental Engineering Sciences Department
1971

BA	Western State College	-	1938
MS	Ohio State University	-	1947
PhD	Ohio State University	-	1954

Atmospheric photo and thermal chemistry, aerosol analysis

100% (50% teaching, 50% research)

"Photochemical and Thermal Reactions of Sulfur Dioxide," Proceedings of the International Symposium on Air Pollution, Union of Japanese Scientists and Engineers, 1972

"Sorption Isotherms of Polar-Nonpolar Systems on Liquid-Coated Adsorbents," Journal Physical Chemistry, 1970 (with Y. Takahashi and G. H. Kennedy)

"Static Studies of Sulfur Dioxide Reactions in Air," Environmental Science and Technology, 2, 1968 (with H. Lutsep and C. M. Noyes)

"A Tracer Study of Meterological Influence on the Dispersion of Ground-Applied Insecticide Aerosols," US Army Medical Research and Development Command, 3/72-6/73, principal investigator

"Reactions and Reaction Products of Sulfur Dioxide in Air," National Science Foundation, 6/72-11/73, principal investigator

"Evaluation of Ozone Generator," General Environmental Equipment Company, Inc., 2/73-4/73, co-investigator

Previous full-time professional experience: 32 yrs. (20 yrs. academic, 3 yrs. industry, 9 yrs. government)

Member, American Industrial Hygiene Association
Member, Air Pollution Control Association
Member, American Society for Testing and Materials
Member, American Chemical Society

JOHN ZOLTEK
Assistant Professor
Environmental Engineering Sciences Department
1972

BS	City College of New York	Civil Engineering	1960
MS	California Institute of Technology	Civil Engineering	1961
PhD	California Institute of Technology	Environmental Engineering Science	1972

Advanced wastewater treatment

100% (40% teaching, 60% research)

Registered professional engineer: California and Florida

Previous full-time professional experience: 7 yrs. (5 yrs. government and 2 yrs. industry)

Diplomate, AAEE
Member, California Water Pollution Control Association
Member, Society of the Sigma Xi

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental	Master's	11	3	42	2	74	6	56	12	58	5	ENROLLMENT
Engineering Sciences	Doctoral	20	1	23	3	20	5	26	6	21	11	

		69-70	70-71	71-72	72-73	73-74	
Environmental	Master's	9	28	58	40	12	GRADUATES
Engineering Sciences	Doctoral	8	3	6	4	4	

Environmental	Master's	1	NON-US NATIONALS
Engineering Sciences	Doctoral	3	

	Master's	Doctoral	
EPA traineeship	26	0	SUPPORT
Graduate assistantship	25	9	
Graduate research assistantship	3	6	
Graduate school fellowship	1	0	
Government employer	0	3	
State employer (Alabama)	2	0	
Self-supported	10	7	
Consulting	20	45	EMPLOYMENT (%)
Industry	10	5	
Federal government	14	10	
Foreign government	3	6	
Other government	20	0	
Academic	5	13	
Further study	10	0	
Military	8	21	
Unknown	10	0	

Florida Technological University

Orlando, Florida

Civil Engineering and Environmental Sciences Department
College of Engineering

Environmental Systems Management
Environmental Engineering

ECPD Accredited--Undergraduate Environmental Engineering Option

Dr. Waldron M. McLellon, Chairman
Civil Engineering and Environmental Sciences
Florida Technological University
PO Box 25000
Orlando, FL 32816
(305) 275-2841

May 1973

The environmental engineering graduate program at Florida Tech was established in 1971 as part of the graduate offerings in the College of Engineering. Emphasis in the program has been in water supply and treatment and wastewater treatment and disposal with subsidiary interests in natural systems, air pollution control, and solid wastes management. An environmental systems management option is available which includes a management minor. Use of systems analysis, operations research, and computer techniques are emphasized. Degrees offered include the MSE and MS.

Florida Technological University is one of nine universities in the Florida system. Enrollment currently totals about 6700 with about 1040 graduate students. FTU is a general purpose university with colleges of education, business, humanities and fine arts, social studies, and natural sciences as well as engineering. The engineering college includes an Environmental Systems Engineering Institute for emphasis on environmental work. Faculty and students are involved heavily in many environmental problems associated with the rapid growth of Central Florida as a major recreational center in a lake region. Tuition and fees for full-time resident graduate students are $240 per quarter. Nonresident costs are $590 per quarter.

Florida Technological University is located on a 1200-acre site about 10 miles east of Orlando. The University has a completely new campus with classes commencing in 1968. Growth has been rapid and is expected to continue. The Orlando area is one of the most rapidly growing in the nation. Walt Disney World about 15 miles southwest has further spurred development. Other major recreational attractions are planned. The University is in the citrus belt and lake region of the state and is within 50 miles of the beaches. Outdoor activities predominate in the mild climate; however, cultural activities such as a thriving art colony are extensive also. The area combines excellent educational, cultural, and recreational environments as well as extensive employment opportunities for constructive professional work.

Admission Requirements

(a) 3.0/4 for last two years.

(b) GRE score of 1000 (total) is requried; advanced examination is not required.

(c) Admission in a post baccalaureate status is a first step toward admission as a regular, degree-seeking MS(MSE) candidate for those who do not meet entrance requirements initially. Completion of an acceptable GRE and satisfactory work allows transfer to regular status. A maximum of 18 quarter hours may be transferred toward the degree program from post baccalaureate status.

(d) Foreign students must take the TOEFL examination as part of the admission requirement.

(e) Any undergraduate BS engineering discipline at an accredited university is acceptable for entry to the graduate program. Individuals with other suitable undergraduate degrees, such as chemistry or biology, are acceptable subject to completion of some prerequisites.

(f) Prerequisites for nonengineers are tailored to fit the student background presented.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	45Q	No	No	27Q	12
MSE--Envir. Engr.	45Q	No	No	27Q	12
MS--Envir. Sys. Mgt.	45Q	No	No	27Q	12

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CEES 471	Urban Planning	McEwan	-	S'72	26
CEES 501	Envir. Engr. Chemistry I	Yousef	-	S'73	11
CEES 502	Envir. Engr. Chemistry II	Yousef	-	S'73	9
CEES 581	Water Resources Engineering	Wanielista	-	A'72	5
CEES 582	Water Resources Economics	Wanielista	-	W'73	10
CEES 611	Envir. Engr. Water Supply	Yousef	-	W'73	9
CEES 612	Envir. Engr. Wastewater	Yousef	-	S'73	23
CEES 614	Water & Wastewater Systems Design	McLellon	-	S'73	3
CEES 615	Air Pollution Control	Wanielista	-	S'73	14
CEES 618	Solid Wastes Management	Wanielista	-	S'72	25
CEES 698	Research Report	Staff	-	All Q's	--
IEMS 431	Engr. Applications of Computer Methods	-	-	W'73	11
IEMS 532	Management Information Systems	-	-	S'73	11
IEMS 602	Engineering Economic Analysis	-	-	W'73	31
IEMS 610	Project Engineering	-	-	S'72	18
IEMS 678	Public Operating Systems Analysis	-	-	W'73	14
IEMS 679	Public Systems Planning & Resource Applications	-	-	S'72	20

CEES 501, 502, 611, 612, 614, and 698 are required. A 9-12Q minor external to the department is required. The IEMS courses shown are but one area of minor interest.

Faculty

WALDRON M. McLELLON
Professor and Chairman
Department of Civil Engineering and Environmental Sciences
1969

BS	US Naval Academy	Naval Science	1941
MCE	Rensselaer Polytechnic Institute	Civil Engineering	1945
MS	Ohio State University	Physics	1952
PhD	Rensselaer Polytechnic Institute	Environmental Engineering	1967

Physical-chemical processes of water and wastewater treatment, environmental quality control, solid wastes, treatment plant operation

100% (50% administration, 25% research, 25% teaching)

"Coagulation of Colloidal and Solution Phase Impurities in Trickling Filter Effluents," Journal Water Pollution Control Federation, 44, 1, 1972 (with T. M. Keinath and C. Chao)

"Correspondence Course Manual for Water Treatment Plant Operators, Class C, 2nd Edition," The South Carolina Water and Pollution Control Association, 304p, 1971 (with W. M. Drewry and J. M. Glennon)

"Carbon Transformation in Activated Sludge Wastewater Treatment Processes," Proceedings, 28th Annual Industrial Waste Conference, Purdue University, 1973 (with Y. A. Yousef)

"Investigation of Water Quality Effects of a Sanitary Landfill in a High Water Table Area," Environmental Protection Administration and Orange County Florida, 10/71-9/73, principal investigator

"Removal of Contaminants from Trickling Filter Effluents by Coagulation," Office of Water Resources Research, 1968-71, co-investigator

Registered professional engineer: Rhode Island, District of Columbia, South Carolina, and Florida

Previous full-time professional experience: 30 yrs. (27 yrs. government and 3 yrs. academic)

Member, AEEP
Chairman-elect, Florida Engineers in Education Practice Section, Florida Engineering Society (1973-74)
Director, Association of Environmental Engineering Professors (1970-72) (also various committees)
Chairman, Conservation and Environmental Quality Committee, Florida Engineering Society (1971-72)

YOUSEF A. YOUSEF
Associate Professor
Department of Environmental Engineering and Sciences
1970

BS	Alexandria University, Egypt	Civil Engineering	1952
MS	University of Texas-Austin	Sanitary Engineering	1962
PhD	University of Texas-Austin	Environmental Health Engineering	1965

Biological treatment processes, water chemistry, design of sanitary systems, fate of pollutants in the natural environment

100% (90% teaching, 10% research)

"Transport of Organic and Inorganic Materials in Small Scale Ecosystems," in "Non Equilbrium Systems in Natural Water Chemistry," Advances in Chemistry, Series 106, American Chemical Society, 1971 (with E. F. Gloyna)

"Carbon Transformation in Activated Sludge Wastewater Treatment Processes," Proceedings, 28th Annual Industrial Waste Conference, Purdue University, 1973 (with W. M. McLellon)

"Radionuclide Transport and Responses to Organic Stress in a Research Flume," Advances in Water Pollution Research, I, 1971 (with E. F. Gloyna)

"Restoration of Lake Eola," Orlando, Florida, 1972-73, co-investigator

"Fate of Pollutants in the Natural Environment," Atomic Energy Commission, 1969-70, co-investigator

Registered professional engineer: Texas

Previous full-time professional experience: 13 yrs. (12 yrs. government and 1 yr. research)

Member, AEEP

MARTIN P. WANIELISTA
Associate Professor
Department of Environmental Engineering and Sciences
1970

BSCE	University of Detroit	Civil Engineering	1964
ME	Manhattan College	Sanitary Engineering	1965
PhD	Cornell University	Water Resources	1971

Water resources, regionalization of treatment facilities, air pollution control, solid waste management, computer applications

100% (50% teaching, 50% research)

"Lake Restoration Methods," Proceedings, 28th Annual Industrial Waste Conference, Purdue University, 1973 (et al.)

"Centralization of Waste Treatment Facilities," Journal Water Pollution Control Federation, 44, 12, 1972 (with C. S. Bauer)

"Flexibility in Water Treatment Plant Design," Journal American Water Works Association, 63, 1971 (with L. M. Falkson)

"Restoration of Lake Eola," Orlando, Florida, 1971-72, principal investigator

"Operating Models for Treatment Plants," Natural Science Foundation, 7/72-8/73, principal investigator

Registered professional engineer: Florida

Previous full-time professional experience: 2 yrs. (government)

Member, AEEP
Reviewer, Scientific and Technical Merit Review for Research and Demonstration Grant Applications, Environmental Protection Agency (1972-73)
Member, Technical Review Committee, Operations Research Society of America (1973-74)
Member, Manpower and Newsletter Committees, Association of Environmental Engineering Professors (1973-74)

Students

		68-69 FT	68-69 PT	69-70 FT	69-70 PT	70-71 FT	70-71 PT	71-72 FT	71-72 PT	72-73 FT	72-73 PT	
Envir. Sys. Mgt.	Master's	-	-	-	-	-	-	25	3	12	4	ENROLLMENT
Envir. Engr.	Master's	-	-	-	-	-	-	2	1	7	6	
Envir. Sys. Mgt.	Master's	-	-	-		-		18		5		GRADUATES
Envir. Engr.	Master's	-		-		-		0		3		
Envir. Sys. Mgt.	Master's		0									NON-US NATIONALS
Envir. Engr.	Master's		0									

	Envir. Sys. Mgt. Master's	Envir. Engr. Master's	
Other traineeship	24	10	
Teaching assistantship	1	7	SUPPORT
Self supported	6	6	
Consulting	38.8		
Industry	5.6		
Other government	33.3		
Academic	5.6		EMPLOYMENT (%)
Further study	5.6	50	
Unknown	11.1	50	

Facilities

Florida Technological University has teaching and research laboratories concentrating on the water and wastewater environment with advanced, modern instrumentation. In addition, it has a campus wastewater treatment plant available and used for research. But beyond these, the university is located in the lake country of Florida in a rapidly changing urban environment. Hence, a natural laboratory exists for examining many environmental effects and creative, productive work on real world problems. Efforts are closely meshed with governmental agencies in solution of local problems.

Georgia Institute of Technology

Atlanta, Georgia

School of Civil Engineering
College of Engineering

Sanitary Engineering

ECPD Accredited--Sanitary Engineering

Dr. Frederick G. Pohland
Sanitary Engineering Department
School of Civil Engineering
Georgia Institute of Technology
Atlanta, GA 30332
(404) 894-2265

March 1974

The graduate program in sanitary engineering at Georgia Tech provides primary emphasis on water quality and pollution control with elective specialties in solid waste technology, air quality control, water resources management, radiological health, and environmental sciences. The program is administered through the School of Civil Engineering but receives complementary support from other academic disciplines, including the Engineering Experiment Station and the Environmental Resources Center.

Training and research opportunities are available to students with both engineering and nonengineering backgrounds, including the physical, chemical, and biological sciences. A student may be awarded a designated or undesignated MS or PhD upon successful completion of degree requirements. Fellowships, teaching assistantships, and research assistantships are available to all students on a competitive basis providing stipends and special allowances for tuition, fees, and dependents.

Admission Requirements

(a) 2.4/4

(b) GRE is not required.

(c) Conditional admission is possible.

(d) A minimum score of 550 on TOEFL.

(e) Any engineering discipline from an ECPD accredited program and also physical, chemical, and biological sciences bachelor's graduates are accepted.

(f) All students entering the MS or PhD program in sanitary engineering must have two years of calculus, one year of physics, one-half to one year of chemistry, hydrology, and some undergraduate sanitary engineering courses.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	50Q	Optional[a]	No	3Q	12
MSCE	50Q	Optional[a]	No	3Q	12
MSSE[b]	50Q	Optional[a]	No	3Q	12
PhD	c	Yes	1	3Q[d]	36

[a] 17Q for thesis or 6Q for research.

[b] Awarded only to those having completed an ECPD accredited undergraduate program in engineering. Other students receive MS Degree.

[c] No fixed course requirements for PhD but both a major and at least one minor field of study must be pursued. Thesis research normally consists of 15Q. Other requirements include: successful completion of comprehensive examinations on courses in major and minor fields, satisfactory completion of the language requirement, thesis defense in a final oral examination.

[d] Three consecutive full quarters.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 2502	Applications of Digital Computers	Staff	2Q	S'73	48
CE 4353	Hydrology	Staff	3Q	S'73	43
CE 4053	Applied Hydraulics	Staff	3Q	W'73	11
CE 4363	Applied Hydrology	Staff	3Q	W'73	31
CE 4373	Water Resources Development	Wallace	3Q	S'73	13
CE 4133	Engr. Aspects of Envir. Health	Stiemke	3Q	W'73	27
CE 4383	Groundwater Hydrology	Staff	3Q	S'73	14
CE 4103	Sanitary Engineering I	Staff	3Q	S'73	45
CE 4113	Sanitary Engineering II	Staff	3Q	S'73	37
CE 4123	Sanitary Engineering III	King	3Q	S'73	8
CE 4143	Man in His Environment	Hoadley	3Q	W'72	32

CE 4713	Sanitary Microbiology	Hoadley	4Q	A'72	14
CE 6053	Steady Flow in Open Channels I	Staff	3Q	A'72	14
CE 6063	Steady Flow in Open Channels II	Staff	3Q	S'72	8
CE 6073	Flow in Enclosed Conduits	Staff	3Q	S'72	6
CE 6083	Sedimendation & Sediment Transport	Staff	3Q	S'73	12
CE 6093	Mechanics of Flow in Porous Media	Staff	3Q	W'72	6
CE 6104	Sanitary Engineering Design I	King	4Q	W'73	9
CE 6114	Sanitary Engineering Design II	King	4Q	S'73	11
CE 6703	Urban Sanitary Facilities	King	3Q	A'71	42
CE 6124	Air Pollution Measurement & Control	King	4Q	A'72	14
CE 6363	Economics in Water Resources	James	3Q	W'73	19
CE 6373	Flood Management	James	3Q	S'73	11
CE 6353	Economical & Financial Aspects of Public Works Planning	James	3Q	A'72	33
CE 6358	Issues in Water Resources Planning & Management	Willeke	3Q	A'72	36
CE 6368	Applied Environmental Resources Mgt.	Willeke	3Q	S'73	11
CE 6133	Basic Radiological Health	Tsivoglou	3Q	A'71	25
CE 6783	Envir. Radiological Surveillance	Tsivoglou	4Q	S'73	15
CE 6113	Industrial Waste Treatment & Disposal	Pohland	3Q	S'73	16
CE 6144	Sanitary Engineering Processes I	Kornegay	4Q	W'73	18
CE 6149	Sanitary Engineering Processes II	Kornegay	4Q	S'73	14
CE 6123	Stream Analysis	Tsivoglou	3Q	W'72	22
CE 6139	Sanitary Chemistry	Staff	4Q	A'72	15
CE 6138	Applied Limnology	Hoadley	3Q	S'72	13
CE 6118	Solid Waste Technology I	Pohland	3Q	W'73	17
CE 6128	Solid Waste Technology II	Pohland	3Q	S'73	8
CE 6145	Field Methods in Envir. Engr.	Staff	5Q	Su'72	13
CE 6148	Advanced Micro. of Water & Wastes	Hoadley	3Q	W'72	10
CE 6108	Instructional Methods in San. Chem.	Staff	3Q	W'73	6
CE 6103	Aquatic Chemistry	Staff	3Q	S'73	8
CE 7000	Master's Thesis	Staff	17Q	-	-
CE 8001	Sanitary Seminar	Staff	1Q	S'73	22
CE 8103	CE Applications of Prob. & Statistics	Sanders	3Q	A'72	21
CE 8756	Research Problem	Staff	1-6Q	S'73	8
CE 6383	Hydrologic Models	Wallace	3Q	W'73	9
CE 6378	Watershed Analysis	Wallace	3Q	A'72	13
CE 6393	Urban Hydrology	Wallace	3Q	S'73	19
CE 6399	Water Resources Systems Engr.	Wallace	3Q	Su'72	18
CE 6398	Hydrology of Floods	Staff	3Q	S'69	5
CE 6388	Hydrologic Simulation	Staff	3Q	W'73	9
CE 8011	Seminar in Envir. Res. Problems	Staff	1Q	A'72	10
CE 8021	Seminar in Envir. Res. Problems	Staff	1Q	W'73	17
CE 9000	Doctor's Thesis	Staff	-	S'73	3
BIOL 4415	Introduction to Radiological Biology	Fetner	4Q	S'73	10
BIOL 6619	Ecological Systems	Benke	3Q	W'73	23
BIOL 6730	Biological Effects of Radiation	Fetner	4Q	S'73	9
ChE 4414	Air Pollution Control	Matteson	3Q	S'72	19
ChE 6610	Aerosol Technology	Matteson	3Q	S'72	7
ChE 6611	Industrial Emission Control	Matteson	3Q	S'73	8
ChE 6612	Atmospheric Reactions	Matteson	3Q	W'73	13
ChE 6613	Technology of Fine Particles	Orr	3Q	W'73	7
CHEM 3411	Physical Chemistry I	Staff	3Q	S'73	37
CHEM 3412	Physical Chemistry II	Staff	3Q	S'73	47
CHEM 3413	Physical Chemistry III	Staff	3Q	S'73	49
CHEM 3311	Organic Chemistry I	Staff	3Q	S'73	36
CHEM 3312	Organic Chemistry II	Staff	3Q	S'73	58
CHEM 3313	Organic Chemistry III	Staff	3Q	S'73	115
CHEM 4511	Bio-Chemistry I	Staff	3Q	S'73	54
CHEM 4512	Bio-Chemistry II	Staff	3Q	A'72	51
CHEM 4513	Bio-Chemistry III	Staff	3Q	W'73	29
CP 6000	Urban Community Planning	Little	3Q	S'73	21
CP 6070	Public Works Planning	Willike	3Q	S'73	29
ECON 6335	Economics of Environmental Quality	James	3Q	Su'72	15
ISyE 3080	Systems Engineering I	Staff	3Q	S'73	13
ISyE 3081	Systems Engineering II	Staff	3Q	W'73	11
ISyE 6734	Methods in Operations Research	Staff	5Q	S'73	24
ISyE 6739	Experimental Statics	Staff	3Q	S'73	25

NE 6220	Radiation Detection	Staff	4Q	Su'71	9
NE 6401	Radiation Protection	Staff	3Q	A'72	22
NE 6643	Envir. Impact of Nuclear Power	Eichholz	-	New'73	-
POL 6255	Governmental Aspects of Planning	Whelan	3Q	W'73	20

CE 4713, CE 6139, CE 6113, CE 8756, CE 8001, ISyE 6739, and two of CE 6104, CE 6114, CE 6144, CE 6149 are required courses.

Faculty

FREDERICK G. POHLAND
Professor
Sanitary Engineering Group
1961

BS	Valparaiso University	Civil Engineering	1953
MS	Purdue University	Civil Engineering (Sanitary)	1958
PhD	Purdue University	Sanitary Engineering	1961

Environmental chemistry and microbiology, solid waste technology, sanitary engineering operations and processes, industrial wastes

100% (50% teaching, 50% research)

"Developments in Anaerobic Treatment Processes," in "Biological Waste Treatment," Biotechnology and Bioengineering Symposium No. 2, Interscience, New York, 1971

"Kinetics of Assimilation of Multiple Substrates in Dispersed Growth Systems," Water Research, 6, 99, 1972

"Phasic Utilization of Substrates by Aerobic Cultures," Journal Water Pollution Control Federation, 44, 3, 376, 1972

Registered professional engineer: Georgia

Previous full-time professional experience: 1 yr. (industry)

Member, AEEP
Member, Water Pollution Control Federation
Member, American Water Works Association
Member, Royal Society of Health
Member, American Chemical Society
Member, American Society for Microbiology

GEOFFREY N. BERLIN
Assistant Professor
Sanitary Engineering Group
1973

BA	Johns Hopkins University	Mathematics	1968
PhD	Johns Hopkins University	Geographic & Environmental Engr.	1973

Environmental and urban engineering, operations research, economics

100% (75% teaching, 25% research)

"Towards a Methodology for Evaluation of Fire Protection Systems in Appalacia," Socio-Economic Planning Sciences, 5, 1971

"Location of Fire Stations," in Systems Analysis for Social Problems (Kamrass, et al., ed.), Wash Operations Research Council, 1970

Previous full-time professional experience: 4 yrs. (2 yrs. government and 2 yrs. industry)

Member, Operations Research Society of America
Member, Institute for Management Science

ALFRED W. HOADLEY
Associate Professor
Sanitary Engineering Group
1968

AB	Harvard College	Engineering & Applied Physics	1957
SB	Harvard College	Sanitary Engineering	1958
MS	University of Wisconsin	Sanitary Engineering	1963
PhD	University of Wisconsin	Sanitary Engineering	1967

Microbiology of water and wastes, limnology

100% (50% teaching, 50% research)

"The Significance of Pseudomonas aeruginosa in Surface Waters," Journal New England Water Works Association, 82, 99, 1968

"Untersuchungen uber Pseudomonas aeruginosa in Oberflachengewassern," I, II, Archiv fur Hygiene und Bakteriologie, 152, 328, 1968

"Some Characteristics of Fluorescent Pseudomonads Isolated from Surface Waters and Capable of Growth at 41C," Canadian Journal of Microbiology, 18, 1769, 1972

Previous full-time professional experience: 10 yrs. (government)

Member, Sigma Xi
Member, Water Pollution Control Federation
Member, American Society for Microbiology
Member, American Society for Limnology and Oceanography
Member, American Institute of Biological Sciences

RICHARD KING
Professor
Sanitary Engineering Group
1950

BSCE	Texas A & M University	Civil Engineering	1938
MSCE	Illinois Institute of Technology	Civil Engineering	1940

Water purification and distribution, wastes collection and treatment, air quality control

100% (85% teaching, 15% research)

"A Review of the Problem of the Imported Fire Ant," Bulletin Georgia Academy of Science, 23, 1965.

Registered professional engineer: Connecticut

Previous full-time professional experience: 8 yrs. (government)

Diplomate, AAEE
Member, American Society of Civil Engineers
Member, American Water Works Association
Member, American Chemical Society
Member, Air Pollution Control Association
Member, Water Pollution Control Federation

BILLY HOWARD KORNEGAY
Associate Professor
Sanitary Engineering Group
1968

BS	Virginia Military Institute	Civil Engineering	1959
MS	Clemson University	Water Resources Engineering	1964
PhD	Clemson University	Environmental Systems Engineering	1969

Water supply, pollution control, kinetics of biological processes, sanitary engineering unit operations and processes

100% (75% teaching, 25% research)

"Kinetics of Fixed-Film Biological Reactors," Journal Water Pollution Control Federation, 4, 11, Part 2, p. R460, 1968

"Application of the Continuous Culture Theory to the Trickling Filter Process," Proceedings, 24th Purdue Industrial Waste Conference, Lafayette, Indiana, May 1969

The Characteristics and Kinetics of Fixed-Film Biological Reactors, Final Progress Report--Federal Water Pollution Control Administration, Grant No. WP-01181, Clemson University, Clemson, SC, August 1969

Previous full-time professional experience: 3 yrs. (2 yrs. industry and 1 yr. consulting)

Member, AEEP
Member, American Society of Civil Engineers
Member, Water Pollution Control Federation
Member, American Chemical Society
Member, Georgia Water and Pollution Control Association

ROBERT E. STIEMKE
Professor
Sanitary Engineering Group
1950

BS	University of Wisconsin	Civil Engineering	1936
MS	University of Wisconsin	Civil Engineering	1940
CE	University of Wisconsin	Civil Engineering	1953

100% (95% teaching, 5% research)

Registered professional engineer: Georgia

Previous full-time professional experience: 10 yrs. (4 yrs. government and 6 yrs. consulting)

Diplomate, AAEE
Member, American Academy of Sanitary Engineers
Member, American Society of Civil Enginers
Member, American Society for Engineering Education
Member, American Water Works Association
Member, Water Pollution Control Federation

ERNEST C. TSIVOGLOU
Professor
Sanitary Engineering Group
1965

BCE	Manhattan College	Sanitary Option	1943
MSCE	University of Minnesota	Sanitary Engineering	1948
PhD	Ohio State University	Physics and Mathematics	1953

100% (50% teaching, 50% research)

"Hydraulic Properties Related to Stream Reaeration," Isotopes Hydrology, 1970; International Atomic Energy Agency, Vienna, 1970

"Symposium on Director Tracer Measurement of the Reaeration Capacity of Streams and Estuaries," US Environmental Protection Agency, Water Pollution Control Research Series, No. 16050 FOR 01/72, 194pp, January 1972

"Characterization of Stream Reaeration Capacity," US Environmental Protection Agency, Ecological Research Series, No. EPA-R3-72-012, 320pp, October 1972

"Nuclear Power: The Social Conflict," Environmental Science and Technology, 5, 404-410, May 1971

Registered professional engineer: Minnesota

Previous full-time professional experience: 18 yrs. (government)

Diplomate, AAEE
Member, Water Pollution Control Federation
Member, American Academy for the Advancement of Science
Member, Minnesota Society of Professional Engineers
Member, Sigma Xi
Member, Sigma Pi Sigma

ROBIN A. WISCOVITCH
Assistant Research Scientist
Sanitary Engineering Group
1973

BS	The Citadel	Chemistry	1964
MS	University of South Carolina	Biochemistry	1969
MAT	The Citadel	Biology	1973

Biochemical and chemical analyses of solid waste, water and wastewater

100% (50% teaching, 50% research)

"The Relationship between Trypsin Exposure Time and Slide Maturity in Different Staining Procedures," Stain Technology, 1974

"SEM Studies of Human Triploid Hairs," Nature New Biology, 1973

"Indirect Measurements of Cerebral Blood Flow by Venous Occlussion Plethysmography," The Physiologist, 1970

Previous full-time professional experience: 7 yrs. (4 yrs. industry and 3 yrs. academic)

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Sanitary Engineering	Master's	15	5	14	8	18	10	21	10	25	13	ENROLLMENT
	Doctoral	2	1	2	1	4	1	5	2	4	2	
Sanitary Engineering	Master's	7		14		25		20		23		GRADUATES
	Doctoral	1		0		0		0		0		
Sanitary Engineering	Master's	2		NON-US NATIONALS								
	Doctoral	1										

	Master's	Doctoral	
EPA traineeship	8	0	SUPPORT
NIH traineeship	2	0	
NDEA Doctoral fellowship	0	1	
NSF Doctoral fellowship	0	2	
Research assistantship	2	2	
Industrial fellowship	1	0	
Government employer	4	0	
Industrial employer	2	0	
Consultant employer	4	0	
Self-supported	4	0	
Consulting	25	0	EMPLOYMENT (%)
R & D	2	50	
Industry	4	0	
Federal government	19	0	
Other government	23	0	
Academic	2	50	
Further study	10	0	
Military	6	0	
Unknown	10	0	

Facilities

The School of Civil Engineering has modular reactors of outstanding design and construction that enable advanced study in sanitary engineering operations and processes. A 16-foot outboard motorboat belonging to Civil Engineering makes possible limnological studies of the many man-made lakes in Georgia. A UCC 1200-1 computer system located in the Civil Engineering Building is available for student use; in addition direct access to an IBM 360 is available when necessary. A five megawatt nuclear reactor is available on campus for students interested in that area of environmental study. The Georgia Tech Library with more than 700,000 bound volumes, 500,000 micro texts, and 200,000 miscellaneous items is a major aid to both graduate and faculty research.

University of Hawaii

Honolulu, Hawaii

Department of Civil Engineering
College of Engineering

Environmental and Sanitary Engineering

ECPD Accredited--Civil Engineering

Dr. Reginald H. F. Young
Department of Civil Engineering
University of Hawaii
2540 Dole Street
Honolulu, HI 96822

March 1974

The emphasis of the environmental and sanitary engineering at the University of Hawaii is in water and wastewater engineering. The areas of specialization are water supply and treatment, domestic and industrial waste treatment, and water quality management. The student can also specialize to some extent in air quality and solid waste management and control in a cooperative program with the Environmental Health Unit of the School of Public Health. The program of study leads to the MS Degree in Civil Engineering.

The University of Hawaii is a land-grant institution and the state supported system of higher education in Hawaii. The distinctive geographical and cultural setting of the Hawaiian Islands has helped the university achieve an excellence in several areas in addition to the land-grant institutional emphasis on engineering and the applied sciences. These areas include oceanography, marine biology, and interdisciplinary studies of tropical environments. University units with which this program maintains a close working relationship in both faculty and student cooperative research and service include the Environmental Center, Water Resources Research Center, Hawaii Institute of Marine Biology, and the Environmental Health Unit of the School of Public Health. Cooperative agreements between the University and the Hawaii Sugar Planters Association, Pineapple Research Institute of Hawaii, and the Honolulu Laboratory of the National Marine Fisheries Service broaden the base of professional and research facility support to the program. The center for cultural interchange between East and West (East-West Center), a federally-supported unit, assists in both student and technical exchange and service programs throughout the Pacific Basin. Tuition and fees for full-time graduate students for an academic year averages $750 for nonresident students and $350 for resident students. The present enrollment at the Manoa campus is about 22,500 with approximately 5000 graduate students.

The Manoa campus is located in the Manoa Valley section of Honolulu, the capital and population center of the State of Hawaii on the island of Oahu. The campus is set in a residential area with the urban cosmopolitan community of about 325,000 population. The academic work on this campus is administered by seven colleges including among these the College of Engineering. The Graduate Division assumes the major role in the administration of all graduate programs. The Manoa campus offers only limited residential facilities and housing in the community is difficult to find and expensive. There are no facilities on campus for married students.

Admission Requirements

(a) 3.0/4 overall or major field GPR.

(b) GRE is not required.

(c) Admission on probational status possible for GPR down to 2.7/4. Students must obtain a 3.0/4 in the first semester to attain regular standing.

(d) TOEFL is required of students from non-English speaking countries. Further evaluation by the English Language Institute required before registration for course work unless student has TOEFL score of 650 or higher or holds degree from an accredited college or university in the United States, Australia, Canada, England, or New Zealand.

(e) Any engineering discipline from an accredited institution is acceptable, and also individuals with undergraduate degrees in chemistry or biology are normally acceptable.

(f) No make-up or prerequisite courses required of nonengineers although a minimum of a credit course in fluid mechanics is desirable.

(g) General examination in specialty area required for admission to candidacy for MS Degree.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	30S	Optional	No	1S	12-18

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 631	Water Quality Management	Dugan	3S	F'72	9
CE 632	Advanced Treatment Technology	Chun	3S	S'73	8
CE 634	Treatment Plant Design	Burbank	3S	S'72	9
CE 635	Sanitary Engineering Chemistry	Chun	3S	F'72	3
CE 636	Sanitary Engineering Microbiology	Young	3S	F'72	7
CE 637	Unit Operations & Processes Lab.	Young	3S	S'72	7
CE 640	Industrial Waste Treatment	Young	3S	S'73	6
CE 641	Marine Disposal of Wastes	Young	3S	F'72	12
CE 624	Ground Water Hydrology	Lau	3S	S'73	26
PH 685	Solid Wastes Mgt. & Control I	Chun	3S	F'72	9
PH 686	Solid Wastes Mgt. & Control II	Chun	3S	S'73	4
PH 687	Solid Wastes Analysis	Chun	4S	F'71	6
PH 688	Solid Wastes Design	Burbank	4S	S'72	3
PH 681	Environmental Health	Johnson	3S	F'72	16
PH 772	Envir. Factors in Health Problems	Burbank	3S	F'72	5
PH 773	Measurement of Envir. Factors	Chun	3S	S'73	4

Environmental and sanitary engineering majors usually take CE 631, 632, 634, 635, 636, and 637.

Faculty

REGINALD H. F. YOUNG
Associate Professor, Department of Civil Engineering
Assistant Director, Water Resources Research Center
1966

BS	University of Hawaii	Civil Engineering	1959
MS	University of Hawaii	Civil Engineering	1965
ScD	Washington University	Environmental & Sanitary Engr.	1967

Water quality management, ground water pollution, wastewater reclamation

100% (50% teaching, 50% research)

"A Study of Wastewater Reclamation by Irrigation," Journal Water Pollution Control Federation, 44, 9, 1972 (with P. C. Ekern and L. S. Lau)

"Return Irrigation Water in Hawaii," Water Resources Bulletin, AWRA Paper No. 73040, June 1973 (with C. Lao)

"Oahu Wastewater Treatment Plant Efficiency," Journal Water Pollution Control Federation, 42, 12, 1970 (with P. L. Chan)

"Pollution in Hawaiian Watersheds," Office of Water Resources Research, 7/70-6/72, principal investigator

"Quality of Coastal Waters," National Oceanic and Atmospheric Administration, 9/71-8/74, co-principal investigator

"Recycling of Water from Sewage by Irrigation," Department of Public Works and Board of Water Supply, City and County of Honolulu, 8/71-7/74, co-principal investigator.

Registered professional engineer: Hawaii

Previous full-time professional experience: 4 yrs. (3 yrs. military and 1 yr. consulting)

Member, AEEP
Member, Water Pollution Control Federation; Member, Research Committee (1971-date)
Member, American Water Works Association
Member, Hawaii Water Pollution Control Association; Secretary-Treasurer (1970); Vice-President (1971); President (1972)

NATHAN C. BURBANK, JR.
Professor of Environmental Health and Sanitary Engineering
School of Public Health
1963

BS	Harvard College	Chemistry	1938
MS	Harvard Graduate School	Sanitary Chemistry	1940
ScD	Massachusetts Institute of Technology	Sanitary Engineering	1955

Water, sewage and industrial waste treatment, design, air pollution, industrial hygiene, solid waste disposal

100% (50% teaching, 30% research, 20% administration)

"Migration of Poliovirus Type II in Percolating Water through Selected Oahu Soils," 5th International Association of Water Pollution Research, Water Resources Research Center, 1970 (et al.)

"The Relative Toxicities of Selected Chemicals to Several Species of Tropical Fish," 5th International Association of Water Pollution Research, Water Resources Research Center, 1970 (with J. H. Nunogawa and R. H. F. Young)

"The Use of Electromagnetic Microwaves for the Control of Fly Larvae in Poultry Manure," Proceedings, 27th Annual Purdue Industrial Waste Conference, Lafayette, Indiana, 1972 (with R. Russell)

"A Study of a Pineapple Cannery Waste," Proceedings, 20th Purdue Industrial Waste Conference, Lafayette, Indiana, 1965 (with J. Kumagai)

"A Study of the Characteristics of Incinerator Quench Water," City and County of Honolulu, 12/71-12/72, principal investigator

"A Study of Baled Refuse in Relation to Marine Environment," Office of Environmental Quality Control, State of Hawaii, 1972, principal investigator

"Leachate-Water Sampling Study at Kawainui Swamp," Department of Parks and Recreation, City and County of Honolulu, 1969-71, principal investigator

Registered professional engineer: Arizona, Maine, Missouri, and Oklahoma

Previous full-time professional experience: 37 yrs. (3 yrs. industry, 28 yrs. academic and 6 yrs. consulting)

Diplomate, AAEE
Member, Water Pollution Control Federation; Member, Nomenclature Committee (1968-69)
Member, American InterSociety Engineering Board; Member, Honorary Membership Committee (1968-69)
National Director, Environmental Management Association (1969-70)

GORDON L. DUGAN
Associate Professor
Civil Engineering
1971

BS	Washington State University	Civil Engineering	1959
MS	Washington State University	Sanitary Engineering	1964
PhD	University of California-Berkeley	Environmental Health Sciences	1970

Wastewater reclamation, agricultural wastes, eutrophication, quality of coastal waters

100% (60% teaching, 30% research, 10% administration)

"Recycling System for Poultry Wastes," Journal Water Pollution Control Federation, 44, 3, 1972 (with C. G. Golueke and W. J. Oswald)

"Response to Tertiary Effluent in Indian Creek Reservoir," Journal Water Pollution Control Federation, 44, 3, 1972 (with C. G. Golueke and W. J. Oswald)

"Eutrophication of Surface Waters--Lake Tahoe," US Environmental Protection Agency, Water Pollution Control Research Series No. 16010 DSW, 1971

"Nutrient, Odor, and Fly Breeding Control of Animal Wastes in a Tropical Environment," 10/72-6/73, principal investigator

"Water Recycling of Sewage Effluent by Irrigation: A Field Study on Oahu," City and County of Honolulu, 9/71-6/74, co-principal investigator

"The Quality of Coastal Water," National Oceanic and Atmospheric Administration, participating faculty

Registered professional engineer: California

Previous full-time professional experience: 12 yrs. (2 yrs. academic, 4 yrs. research, 3 yrs. government, 3 yrs. industry)

Member, American Society of Civil Engineers (national and local)
Member, Water Pollution Control Federation (national and local)
Member, American Society of Limnology and Oceanography

L. STEPHEN LAU
Professor, Department of Civil Engineering
Director, Water Resources Research Center
1959

BS	University of California-Berkeley	Civil Engineering	1953
MS	University of California-Berkeley	Civil Engineering	1955
PhD	University of California-Berkeley	Hydraulics & Sanitary Engineering	1959

Water resources, ground water hydrology, coastal water quality, wastewater reclamation by irrigation, ground water hydraulics

50% (10% teaching, 40% research)

"Quality of Coastal Waters," First Annual Progress Report, Technical Report 60, Water Resources Research Center, University of Hawaii

"A Study with Wastewater Reclamation by Irrigation," Journal Water Pollution Control Federation, 44, 9, 1972 (with R. H. F. Young and P. C. Ekern)

"Hydrologic Systems in Hawaii," Systems Approach to Hydrology, 1971 (et al.)

"Quality of Coastal Waters," National Oceanic and Atmospheric Administration, National Sea Grant Program, 9/71-8/74, principal investigator

"Water Recycling of Sewage Effluent for Irrigation," City and County of Honolulu, 7/71-6/74, principal investigator

"Pollution and Reuse of Wastewater Effluents and Surface Runoff in Hawaii," Office of Water Resources Research, 7/69-6/72, principal investigator

Previous full-time professional experience: 12 yrs. (academic)

Member, Hawaii Section American Water Resources Association; President (1972)
Member, Water Pollution Control Federation; Member, Research Committee (1966-71)
Member, Universities Council on Water Resources (1967-date)

MICHAEL J. CHUN
Associate Professor
Environmental Health
1970

BS	University of Kansas	Civil Engineering	1966
MS	University of Hawaii	Civil Engineering	1968
PhD	University of Kansas	Environmental Health	1970

Biological treatment of wastewater, solid waste, water quality, environmental health

100% (70% teaching, 20% research, 10% administration)

"A Characterization of Tuna Cannery Waste," Water and Sewage Works, 117, 9, 1970

"Quality of Wastewater Effluent and Runoff in Hawaii," Water Resources Research Center Technical Report No. 63, University of Hawaii, 1972 (et al.)

Registered professional engineer: Engineer-in-Training, Kansas

Previous full-time professional experience: 9 mos. (government)

JERRY M. JOHNSON
Associate Professor and Head, Environmental Health Unit
Assistant Director, Environmental Center
School of Public Health
PhD University of Minnesota Environmental Health 1969
Environmental planning, water quality related research, environmental health
100%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Envir. & San. Engr.	Master's	4	2	10	3	13	6	10	8	13	7	ENROLLMENT
Envir. & San. Engr.	Master's	1		1		3		9		8		GRADUATES
Envir. & San. Engr.	Master's	3		NON-US NATIONALS								

	Master's	
EPA traineeship	3	
Research assistantship	5	
Other university support	2	
Government employer	4	SUPPORT
Consultant employer	1	
Self-supported	5	

Consulting	57	
Federal government	19	
Foreign government	14	EMPLOYMENT (%)
Other government	5	
Military	5	

Facilities

The University of Hawaii has excellent facilities for assessing the ecological effects of waste discharges into coastal and marine environments. The equipment, instrumentation, and expertise of the Hawaii Institute of Marine Biology and Hawaii Institute of Geophysics are available for both biological and oceanographic studies. The Water Quality Laboratory and cooperating laboratories in agricultural chemistry, agronomy and soil science, and pesticides research provide support for advanced research on transport and biological uptake of pesticides and heavy metals. The Institute of Geophysics provides facilities for detection and measurement of environmental isotopes.

University of Idaho

Moscow, Idaho

Civil Engineering Department
College of Engineering

Civil Engineering

Dr. A. T. Wallace, Professor
Civil Engineering Department
University of Idaho
Moscow, Idaho 83843
(208) 885-6782

March 1974

The sanitary engineering program is process engineering oriented. All course work is directed toward analysis and design of water and wastewater treatment systems. The MS and MCE (non-thesis) degrees are the degrees offered within the program.

Admission Requirements

(a) 2.75/4 for either MS or MCE.

(b) GRE is not normally required.

(c) Admission is possible for GPA down to 2.2/4 with previous satisfactory professional experience. Students must attain a 3.0/4 during first semester to achieve full graduate standing. Failure to do so may result in being dropped.

(d) Foreign students with language difficulties are not normally accepted.

(e) Any engineering discipline at an accredited institution is acceptable.

(f) Individuals without undergraduate engineering degrees would be expected to satisfy all departmental requirements in mathematics, engineering science, hydraulics, hydrology and sanitary engineering before achieving regular graduate student standing. Other requirements are possible depending on background.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	30S	Yes	No	1S	12
MCE--Civil Engineering	33S	No	No	1S	12

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 531	Unit Operations of Sanitary Engr.	Wallace[1]	-	F'73	9
CE 532	Unit Processes of Sanitary Engr.	Wallace[1]	-	S'74	8
CE 534	Sanitary Engineering Analysis	Wallace[1]	-	S'74	4

[1] Dr. J. E. Ongerth, Washington State University, may alternate as instructor in these courses.

Faculty

ALFRED T. WALLACE
Professor
Department of Civil Engineering
1967

BS	Rutgers University	Sanitary Engineering	1959
MS	University of Wisconsin	Civil Engineering	1960
PhD	University of Wisconsin	Civil Engineering	1965

Unit operations and processes of water and wastewater treatment, industrial wastes, groundwater pollution

100% (75% teaching, 25% research)

"Analysis of an Aquatic Environment Receiving Domestic and Industrial Effluents," Proceedings, Conference on Trace Substances in Environmental Health, University of Missouri, pp. 69-84, June 1970 (with L. L. Mink and R. E. Williams)

"The Effect of Drain Wells on the Quality of Ground-Water in the Snake River Plain," Idaho Bureau of Mines and Geology, Pamphlet No. 148, November 1970 (with D. E. Abbegglen and R. E. Williams)

"Characterization of Time-Varying Organic Loads," Journal Sanitary Engineering Division, American Society of Civil Engineers, 97, SA3, pp. 257-268, June 1971 (with D. M. Zollman)

Two chapters: "Equalization" and "Neutralization and pH Control," in Process Design in Water Quality Engineering (W. W. Eckenfelder, Jr., ed.), Jenkins Publishing Company, New York, 1972

"Impact of Septic Tanks in the Ada-Canyon County Area of SW Idaho," Walla Walla District, Corps of Engineers, 1974, co-principal investigator

"Denitrification of Fertilizer Manufacturing Effluents," J. R. Simplot Company, 1973

Registered professional engineer: Idaho, Washington, and Montana

Previous full-time professional experience: 7 yrs. (3 1/2 yrs. academic, 3 yrs. industry, and 1/2 yr government)

Member, AEEP
Diplomate, AAEE
President, Pacific NW Pollution Control Association (1974)
Member, American Society of Civil Engineers; Member, Publications Review Committee, Environmental Engineering Division
Chairman, Idaho Water and Sewage Works Certification Boards (1968-date)

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Civil Engineering	Master's	2	1	5	1	6	1	7	0	4	1	ENROLLMENT
Civil Engineering	Master's	1		2		6		2		3		GRADUATES
Civil Engineering	Master's	0		NON-US NATIONALS								

	Master's	
EPA fellowship	9	
EPA traineeship	1	
Research assistantship	1	
Teaching assistantship	1	SUPPORT
Other university support	1	
Industrial support	3	
Governmental employer	2	
Consultant employer	1	
Self-supported	1	

EMPLOYMENT (%)

	Master's*
Consulting	41
Industry	4
Federal government	14
Other government	23
Military	14
Outside environmental area	4

*Includes 8 students who have not yet fulfilled graduation requirements.

University of Illinois-Urbana-Champaign

Urbana, Illinois

Department of Civil Engineering
College of Engineering

Environmental Engineering

ECPD Accredited--Civil Engineering (Environmental Engineering)

Dr. R. S. Engelbrecht
Professor of Environmental Engineering
3230 Civil Engineering Building
University of Illinois
Urbana, IL 61801
(217) 333-3822

March 1974

The University of Illinois offers programs leading to advanced degrees at the Urbana-Champaign campus, as well as at the Medical Center and Chicago Circle campuses in Chicago. The Graduate College enrollment at Urbana-Champaign includes students from every state plus 88 foreign countries and exceeds 8,000 out of a total campus enrollment of about 32,000. A graduate faculty of nearly 1,800 offers instruction leading to advanced degrees in over 100 fields of study. This large faculty and diverse student population, together with comprehensive library resources, numerous special laboratories and facilities, and a wide selection of social and cultural activities, make the University of Illinois at Urbana-Champaign an especially attractive environment for graduate study.

Urbana-Champaign is one community composed of two municipalities with a total population (including students) of about 100,000 and is located about 140 miles south of Chicago. It is the center of one of the nation's richest farming areas and has a number of prosperous industrial plants.

The environmental engineering graduate program within the Department of Civil Engineering covers instruction and research in water quality control and air resources. Within the framework of this emphasis, students may specialize in one of several areas, including aquatic biology, water chemistry, water and wastewater treatment, solid wastes, atmospheric chemistry, environmental systems analysis, aerosol technology, and meteorology. Students may also follow a broader program of environmental health engineering or air and water resources. The program is sufficiently flexible to accommodate a wide variety of student interest and background. Master's degree recipients are prepared to undertake responsible employment with regulatory and advisory agencies, industries, and consulting organizations concerned with environmental problems. The objective of the doctoral program is to provide qualified individuals with the fundamental background required for careers in teaching and research, and related positions involving research and development with industry and government agencies. There is substantial interdepartmental cooperation with various departments and programs of the University which encourages the development of a coordinated approach to the solution of complex environmental problems.

Admission Requirements

(a) 3.0/4 for MS; 3.5/4 for previous graduate studies for PhD.

(b) GRE is not required, but is recommended.

(c) Admission is possible with GPA of 2.75/4 provided strong recommendations are submitted; special consideration is given veterans.

(d) A TOEFL score of 480 is required for admission of foreign students.

(e) Admission is granted to graduates of institutions whose requirements for the bachelor's degree are substantially equivalent to those of the University of Illinois, provided the applicant's preparation is appropriate to advanced study. Students with baccalaureate degrees in engineering or the biological or physical sciences may be admitted to the program without extensive prerequisites.

(f) Nonengineers must demonstrate competence in calculus and fluid mechanics plus a background in unit operations and processes appropriate to environmental quality control or take courses for credit to satisfy these requirements.

(h) Applications for doctoral study are individually reviewed, taking into account all supporting evidence of qualifications; GPA of 3.5/4 for previous graduate studies recommended; comprehensive review of all academic work and experience.

Degree Requirements

Degree	Credits[a]	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	8U[b]	Yes	No	2S	11
MS--Envir. Engr.	9U	No	No	2S	11
PhD--Envir. Engr.	24U	Yes[c]	Yes	4S	36

[a] Includes thesis except for nonthesis option which includes 1U independent study.

[b] One unit is equivalent to 4 semester hours.

[c] Several alternate ways of satisfying language requirement.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 340	Physical Princ. of Envir. Engr. Proc.	Chian	3/4U	F'73	40
CE 341	Air Resources Management	Stukel	1/2U	S'74	52
CE 342	Water Quality Control Processes	Snoeyink	3/4U	S'74	19
CE 343	Chemical Princ. of Envir. Engr. Proc.	Snoeyink	1U	F'73	33
CE 344	Solid Waste Management	Pfeffer	1U	F'73	16
CE 345	Environmental Health Engineering	Leland	3/4U	F'73	37
CE 346	Biol. Princ. of Envir. Engr. Proc.	Engelbrecht	3/4U	S'74	46
CE 347	Aquatic Ecology	Leland	3/4U	S'74	16
CE 348	Air Pollution Seminar	Stukel	1/2U	S'74	70
CE 359	Dynamics of Aerosols & Hydrosols	Morrison	1U	F'73	10
CE 440	Water Treatment Processes	Chian	1U	F'73	20

CE 442	Wastewater Treatment Processes	Pfeffer	1U	S'74	37
CE 443	Unit Operations in Envir. Engr. (Lab)	Chian	1U	S'74	19
CE 444	Treatment of Industrial Wastes	Semmens	3/4U	Su'73	22
CE 445	Water Quality & Pollution	O'Connor	1U	F'73	20
CE 446	Design of Water & WW Treatment Plants	Riddle O'Connor	1U	S'74	21
CE 448	Control of Air Pollution	Stukel	1U	F'73	20
CE 449	Analysis of Air Pollutants	Rigo	1U	S'74	9
CE 455	Transport Processes in Water	Holley	1U	S'74	15
CE 497AR	Air Resources Engineering	Stukel	3/4U	F'73	30
CE 497OW	Optimization of Water Quality Systems	Liebman	1/2U	S'74	12
CE 495	Environmental Engineering Seminar	Engelbrecht	1/4U	S'74	46
CE 495AG	Advanced Envir. Engr. Seminar	Snoeyink	0U	S'74	7
GE 360	Engr. Appl. of Meterological Fund.	Pearson	1U	F'73	16
ME 393	Air Pollution & Combustion	Strehlow	1U	F'73	51
CE 350	Hydrology	Chow	1U	F'73	19
CE 352	Water Resources Design	Tauxe	3/4U	F'73	11
CE 391	Computer Methods in Civil Engr.	Lopez	1U	S'74	13
CE 452	Water Resources	Chow	1U	S'73	14
Chem 340	Principles of Physical Chemistry	Schmidt	1U	F'73	85
Micro 309	Comparative Microbial Chemistry	Wolin	1/2U	S'74	35
Bioch 350	General Biochemistry	McClure	3/4U	S'74	291
ChE 381	Chemical Reaction Engineering	Schmitz	1/2U	S'74	39
Agron 340	Introduction to Applied Statistics	Seif	3/4U	F'73	90

Students intending to specialize in water quality control are required to be knowledgeable of the subject matter covered in CE 340, 343, 346, 440, and 442 or take these courses.

The course requirements for those students specializing in air resources are CE 340, 341, 346, 448, 449, ME 393, and GE 360.

Faculty

RICHARD S. ENGELBRECHT
Professor of Environmental Engineering
Department of Civil Engineering
1954

AB	Indiana University	Microbiology	1948
MS	Massachusetts Institute of Technology	Sanitary Science	1952
ScD	Massachusetts Institute of Technology	Sanitary Science	1954

Environmental microbiology (bacteria, viruses), water and wastewater treatment, solid waste treatment and disposal, environmental health

100% (30% teaching, 30% research, 40% administration)

"Removal of Viruses from Water by Chemical Coagulation and Flocculation," Journal American Water Works Association, 62, 9, 1970 (with M. Chaudhuri)

"Virus Removal in Wastewater Renovation by Chemical Coagulation and Flocculation," Advances in Water Pollution Research, 5th International Water Pollution Research Conference, 1970 (with M. Chaudhuri)

"Microbial Substrate Storage in Activated Sludge," Journal Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, 94, SA2, 1968 (with C. F. Walters and R. E. Speece)

"Removal of Nematodes by Rapid Sand Filtration," Journal Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, 95, SA1, 1969 (with I. Wei and J. H. Austin)

"Cell Replication and Biomass in the Activated Sludge Process," Water Research, 7, 1973 (with R. E. Speece and D. R. Aukamp)

"New Microbial Indicators of Wastewater Chlorination Efficiency," US Environmental Protection Agency, 12/69-3/72, principal investigator

"New Microbial Indicators of Disinfection Efficiency," US Army Medical Research and Development Command, 4/72-3/74, principal investigator

"Removal of Viruses in Water by Diatomite Filtration," US Public Health Service, 2/69-8/71, principal investigator

Member, AEEP
Member, Water Pollution Control Federation; Chairman, Research Committee (1971-date); Member, Executive Committee (1972-date)
Member, Central States Water Pollution Control Association; President (1970); Director to Federation (1972-date)
Chairman, Illinois American Water Works Association (1971)
Chairman (1967-72) and Consultant (1972-date), Engineering and Urban Health Sciences Study Section, US Environmental Protection Agency
Consultant, Training grants programs, Water Quality Office, US Environmental Protection Agency (1965-date)

JON C. LIEBMAN
Professor of Environmental Engineering
Department of Civil Engineering
1972

BS	University of Colorado	Civil Engineering	1956
MS	Cornell University	Sanitary Engineering	1963
PhD	Cornell University	Sanitary Engineering	1965

Environmental systems analysis, water quality systems, solid waste systems, mathematical optimization

100% (50% teaching, 40% research, 10% administration)

"An Analysis of Private and Public Sector Location Models," Management Science, 16, 10, 1970 (with C. S. ReVelle and D. H. Marks)

"Location Models: A Solid Waste Collection Example," Journal Urban Planning and Development Division, Proceedings of the American Society of Civil Engineers, 97, UP1, 1971 (with D. H. Marks)

"Operating Rules for Joint Operation of Multiple Raw Water Sources," Water Resources Research, 7, 2, 1971 (with E. F. Joeres and C. S. ReVelle)

"Simulation Model of Urban Refuse Collection," Journal Sanitary Engineering Division, American Society of Civil Engineers, 95, SA2, 1969 (with M. M. Truitt and C. W. Kruse)

"A Heuristic Aid for the Design of Sewer Networks," Journal Sanitary Engineering Division, American Society of Civil Engineers, 93, SA4, 1967

"Optimal Routing of Solid Waste Collection Vehicles," US Environmental Protection Agency, 6/71-11/73, principal investigator

"Mathematical Analysis of Solid Waste Collection," US Environmental Protection Agency, 3/69-2/70, principal investigator

"Biological Conversion of Organic Refuse to Methane," National Science Foundation, 6/1/73-5/30/74, co-investigator

Previous full-time professional experience: 12 yrs. (7 yrs. academic and 5 yrs. military)

Member, AEEP
Member, Study Section on Environmental and Urban Health Sciences, US Environmental Protection Agency, (1970-72)
Consultant, (Baltimore) Regional Planning Council (1967-72)

JOHN T. O'CONNOR
Professor of Civil Engineering
Department of Civil Engineering
1961

BE	The Cooper Union	Civil Engineering	1955
MS	Newark College of Engineering	Sanitary Engineering	1958
DEng	The Johns Hopkins University	Sanitary Engineering	1961

Water and wastewater treatment, aqueous chemistry of metals, industrial water and wastes treatment, unit processes and unit operations laboratory

100% (65% teaching, 35% research)

Environmental Engineering Unit Operations and Unit Processes Laboratory Manual (editor), Association of Environmental Engineering Professors, 1972

Water Quality and Treatment, "Chapter 11: Iron and Manganese Removal," "Chapter 13: Management of Water Treatment Plant Residues," American Water Works Association Manual, McGraw-Hill, 1971

"Biologically Mediated Chemical Changes in the Filtration of Aerated Ground Waters," Journal American Water Works Association, 63, 5, 1971 (with K. Y. Baliga)

"Emergency Water Disinfection Practice," in "Disinfection," Proceedings, American Society of Civil Engineers Third National Symposium on Sanitary Engineering Research, University of Massachusetts, Amherst, 1970 (with S. K. Kapoor)

"Mobile Water and Wastewater Treatment Systems," US Air Force, 1971-72, co-investigator

"Disinfection of Small Quantities of Water," US Army, 1967-69

"Control of Bacterial Growths in Sand Filters Used for Iron Removal," Office of Water Resources Research, 1967-69, principal investigator

Registered professional engineer: New York and Illinois

Previous full-time professional experience: 3 yrs. (2 yrs. consulting and 1 yr. industry)

Member, AEEP
Member, Environmental Engineering Division, American Society of Civil Engineers; Editor, Newsletter (1970-73); Secretary (1973-date)
Member, American Water Works Association; Chairman, Student Activities Committee (1969-date)
Member, Board of Directors, Association of Environmental Engineering Professors (1971-date)

JOHN E. PEARSON
Professor of General, Civil and Nuclear Engineering and
Associate Director, Institute for Environmental Studies
General, Civil and Nuclear Engineering
1939

BS	Purdue University	Mechanical Engineering	1935
MS	California Institute of Technology	Meterology	1943

Air resources management, micro structure of the atmospheric boundary layer

100% (30% teaching, 10% research, 60% administration)

A Study of Environmental Pollution by Lead, Illinois Institute for Environmental Quality Document No. 71-7, 1971 (et al.)

Natural Environmental Radioactivity from Radon-222, US Department of Health, Education and Welfare, Environmental Health Series No. 999-RH-26, 1967

Radon-222, A Study of Its Emanation from Soil, Source Strength, and Use as a Tracer, US Public Health Service Final Report, AP-00134, Department of General Engineering, University of Illinois, 1965

Registered professional engineer: Illinois

Previous full-time professional experience: 4 yrs. (research)

Member, Air Pollution Control Association; Member and Past Chairman, Meterological Committee
Consultant, European Regional Office, World Health Organization (1973)

JOHN T. PFEFFER
Professor of Sanitary Engineering
Department of Civil Engineering
1967

CE	University of Cincinnati	Civil Engineering	1958
MS	University of Cincinnati	Sanitary Engineering	1959
PhD	University of Florida	Sanitary Engineering	1962

Wastewater treatment and disposal, solid waste processing and disposal, environmental quality control

100% (50% teaching, 50% research)

"Increased Loadings on Digester with Recycle of Digested Solids," Journal Water Pollution Control Federation, 40, 11, 1968

"Population Dynamics in Anaerobic Digestion," Journal Water Pollution Control Federation, 39, 8, 1967 (with M. Leither and J. Worlund)

"Field Evaluation of Aerators in Activated Sludge Systems," Water and Sewage Works, 115, 11, 1968 (with F. C. Hart and L. A. Schmid)

"Aeration with ORP Control to Suppress Odors Emitted from Liquid Swine Manure Systems," Livestock Waste Management and Pollution Abatement, American Society of Agricultural Engineers, St. Joseph, Michigan, 1971 (et al.)

"Reclamation of Energy from Organic Refuse," US Environmental Protection Agency, 8/72-2/73, principal investigator

"Rest Area Wastewater Treatment and Disposal," Illinois Department of Transportation, 4/72-6/74, principal investigator

"Biological Conversion of Organic Refuse to Methane," National Science Foundation, 6/1/73-5/30/74, principal investigator

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MATTHEW D. R. RIDDELL
Adjunct Professor
Department of Civil Engineering
1973

SB	Harvard College	Engineering Sciences	1940
MS	Harvard Graduate School of Engineering	Sanitary Engineering	1946

Design of water and wastewater treatment plants

25% (teaching)

"Selection of Disposal Methods for Wastewater Treatment Plants," Proceedings, 10th Sanitary Engineering Conference, University of Illinois, Urbana, 1968

"Do You Live Downstream--A Summary of Recent Progress in Water Pollution Control," Proceedings of Illinois Association of Sanitary Districts, 1967

"Modernizing Aging Utility Systems," American Public Works Association Yearbook, 1961

"Considerations in Selecting Distribution Storage Facilities," Journal American Water Works Association, 46, 6, 1954

"Sewage Treatment at Madison, Wisconsin," Water and Sewage Works, 1, 1948

Registered professional engineer: Illinois, Michigan, Minnesota, South Dakota, Wisconsin, and New York

Previous full-time professional experience: 27 yrs. (consulting)

Diplomate, AAEE
Trustee, Environmental Engineering Intersociety Board, Inc. (1969-72; 1972-date)
Member, Technical Advisory Committee, Building Research Advisory Board (1959-62)
Member, Water Resources Technical Advisory Committee, Northeastern Illinois Planning Commission (1968-date)
Member, Consulting Engineers Council of Illinois; Member, Environmental Committee (1971-date)

JAMES J. STUKEL
Associate Professor of Mechanical Engineering and Civil Engineering
Departments of Civil Engineering and Mechanical Engineering
1968

BS	Purdue University	Mechanical Engineering	1959
MS	University of Illinios, Urbana-Champaign	Mechanical Engineering	1963
PhD	University of Illinois, Urbana-Champaign	Mechanical Engineering	1968

Air resources management, air pollution control, theory and measurement of aerosol suspensions, aerosol deposition on surfaces under dynamic conditions, measurement of the transport properties of aerosol suspensions, atmospheric transport of aerosol suspensions

100% (70% teaching, 20% research, 10% administration)

"Integral Method as Applied to a Turbulent Boundary Layer of a Gas-Solid Suspension," Powder Technology, 4, 2, 1971

"High Temperature Dust Control Application to a Combination Particle Collector and Heat Exchanger," Proceedings, 1st International Conference on Pollution, Scientific and Engineering Solutions, Tel Aviv, Israel, 1972, 2, Plenum Press, 1973 (with H. G. Rigo)

"Measurement of Mass Flow and Density of Aerosols in Transport," Environmental Science and Technology, 3, 4, 1969 (with S. L. Soo and J. M. Hughes)

"Environmental Pollution by Lead and Other Metals--Aerosol Deposition Section," National Science Foundation (RANN), 5/71-5/73, participant

"Environmental Pollution by Lead and Other Metals--Atmospheric Dispersion of Aerosols Section," National Science Foundation (RANN), 5/71-5/73, participant

"Hydrodynamics of Aerosol Suspensions," University of Illinois, 9/72-9/73, principal investigator

Previous full-time professional experience: 2 yrs. (industry)

Member, American Society of Civil Engineers; Member, Atmospheric Pollution Committee; Representative, Intersociety Subcommittee No. 10 on Particulates

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EDWARD S. K. CHIAN
Assistant Professor of Environmental Engineering
Department of Civil Engineering
1971

Diploma	Taipei Institute of Technology	Chemical Engineering	1955
MS	Oklahoma State University	Chemical Engineering	1959
ChE	Massachusetts Institute of Technology	Chemical Engineering	1964
ScD	Massachusetts Institute of Technology	Biochemical Engineering	1967

Treatment of water and wastewater by physical processes, advanced theory of water treatment, reverse osmosis and ultrafiltration, recovery of microbial proteins from highly concentrated waste streams

100% (50% teaching, 50% research)

"Growth of Mixed Cultures on Mixed Substrates: I. Continuous Cultures," Applied Microbiology, 16, 9, 1968 (with R. I. Mateles)

"Kinetics of Substrate Uptake in Pure and Mixed Culture," Environmental Science and Technology, 3, 6, 1969 (with R. I. Mateles)

"Ultrafiltration of Biological Materials," Process Biochemistry, 4, 10, 1969 (with J. T. Selldorff)

"In Situ Steam Sterilization of Membrane Filters," Biotechnology and Bioengineering, 8, 1971 (et al.)

"Development of a Continuous Regenerating Moving Bed to Remove Oil from Oil-Water Suspensions," Hydronautics Inc. Technical Report 7080-1, MARAD Contract C-0-35467, 1971 (with A. Golland and F. E. Witmer)

"Treatment of Leachate from Sanitary Landfills," US Environmental Protection Agency, 7/72-8/74, principal investigator

"Evaluation of New Reverse Osmosis Membrane for the Separation of Toxic Organic Compounds from Wastewater," US Department of the Army, 9/72-8/75, principal investigator

"Evaluation of Methods for the Recycle of Wastewaters from Washracks Located at Army Facilities," US Department of the Army, 9/72-9/73, principal investigator

Previous full-time professional experience: 6 yrs. (2 yrs. consulting and 4 yrs. industry)

HARRY V. LELAND
Assistant Professor of Environmental Biology
Departments of Civil Engineering and Zoology
1968

BA	University of California-Riverside	Zoology	1959
MA	Southern Illinois University	Zoology	1964
PhD	University of Michigan	Water Resources	1969

Limnology, biology of water pollution, nutrients and toxic materials in natural waters, environmental health, stream and reservoir management

100% (50% teaching, 50% research)

"Factors Affecting Distribution of Lead and Other Trace Elements in Sediments of Southern Lake Michigan," in Trace Metals and Metal-Organic Interactions in Natural Waters (P. Singer ed.), Ann Arbor Science Publishers, in press (with S. S. Shukla and N. F. Shimp)

"Chlorinated Hydrocarbon Insecticides in Sediments of Southern Lake Michigan," Environmental Science and Technology, in press (with W. N. Bruce and N. F. Shimp)

"Trace Elements in Southern Lake Michigan," in Chemistry and Biology of Trace Metals in the Environment (H. A. Laitinen and R. L. Metcalf, eds.), University of Illinois Press, Urbana, 1972 (with N. F. Shimp)

"An Interdisciplinary Study of Environmental Pollution by Lead and Other Metals," National Science Foundation, 11/71-11/74, co-investigator

"Heavy Metal Accumulations in Lake Michigan," Office of Water Resources Research, 6/71-7/73, principal investigator

Member, Water Pollution Control Federation; Member, Research Committee (1972-date)
Member, American Society of Limnology and Oceanography (1967-date)
Consultant, Army Corps of Engineers, Environmental Impacts (1972-date)

MICHAEL J. SEMMENS
Assistant Professor of Environmental Engineering
Department of Civil Engineering
1973

BSc	Imperial College, London	Chemical Engineering	1968
MSc	Harvard Graduate School	Environmental Engineering	1970
PhD	University College, London	Public Health Engineering	1973

Water and wastewater treatment, chemical and physical unit processes for water treatment, ion exchange, industrial waste treatment

100% (50% teaching, 50% research)

"Sorption of Carboxylate Ions by Strongly Basic Anion Exchangers," The Chemical Society, Faraday Transactions I, 68, 1972 (with J. Gregory)

"Ion Exchange Behavior of Organic Anions on Strong Base Resins," Science Research Council, England, 10/70-12/72, principal investigator

Previous full-time professional experience: 1 yr. (consulting)

VERNON L. SNOEYINK
Associate Professor of Sanitary Engineering
Department of Civil Engineering
1969

BS	University of Michigan	Civil Engineering	1964
MS	University of Michigan	Sanitary Engineering	1966
PhD	University of Michigan	Water Resources Engineering	1968

Water chemistry, chemistry of water treatment processes, chemical process design

100% (50% teaching, 50% research)

"Surface Functional Groups on Carbon and Silica," in Progress in Surface and Membrane Science (J. Danelli, et al., eds.), 5, 1972 (with W. J. Weber, Jr.)

Water Chemistry Laboratory Manual, Association of Environmental Engineering Professors, 1972 (et al.)

"Competitive Adsorption from Bisolute Systems on Active Carbon," Journal Water Pollution Control Federation, accepted for publication, 1973 (with J. S. Jain)

"Ammonia Removal by Chlorination Followed by Contact with Active Carbon," Journal Water Pollution Control Federation, accepted for publication, 1973 (with R. C. Bauer)

"Study of Adsorption Systems and Mobile Water and Wastewater Treatment Plants," US Air Force, 6/71-2/74, principal investigator

"Ammonia Removal by Chlorination Followed by Contact with Activated Carbon," Office of Water Resources Research through the Illinois Water Resources Center, 7/73-6/74, principal investigator

"Chlorination of Secondary Effluents," Illinois Institute for Environmental Quality, 2/73-9/73, principal investigator

Previous full-time professional experience: 1 yr. (consulting)

Member, AEEP
Member, American Water Works Association; Vice Chairman, Research Committee on Organic Contaminants in Water
Member, Committees on Undergraduate Education, Water Chemistry Laboratory Manual, and Seminars, Association of Environmental Engineering Professors
Member, Illinois Section American Water Works Association; Member, Committee on Student Activities

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EARL DOWNEY BRILL, JR.
Assistant Professor of Civil Engineering
Department of Civil Engineering and Institute for Environmental Studies
1973

BS	Cornell University	Civil Engineering	1969
PhD	The Johns Hopkins University	Environmental Engineering	1972

100% (40% teaching, 40% research, 20% administration)

Environmental systems analysis, environmental economics, water resources systems analysis

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SHELDON J. PLAGER
Professor of Law and Director, Office of Environmental and Planning Studies
College of Law
JD University of Florida Law 1958
Environmental law, energy resources, property law, land use planning
20%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	12	3	35	5	39	7	57	9	48	7	ENROLLMENT
	Doctoral	11	0	8	0	10	0	15	0	18	1	

		69-70	70-71	71-72	72-73	73-74	
Environmental Engineering	Master's	9	12	23	41	31	GRADUATES
	Doctoral	2	1	1	3	4	

Environmental Engineering	Master's	7	NON-US NATIONALS
	Doctoral	10	

	Master's	Doctoral	
EPA traineeship	24	0	SUPPORT
Research assistantship	14	14	
Teaching assistantship	1	1	
Other university support	2	1	
Government employer	4	1	
Consultant employer	4	0	
Self-supported	6	1	
WHO	0	1	

	Master's	Doctoral	
Consulting	17	20	EMPLOYMENT (%)
Industry	25	0	
Federal government	8	0	
Other government	22	0	
Academic	4	80	
Further study	15	0	
Military	3	0	
Unknown	6	0	

Facilities

The facilities of the Department of Civil Engineering for research and teaching in environmental engineering are among the finest in the country. The Environmental Engineering Laboratory, located in the new Civil Engineering Building, has over 11,000 sq ft of laboratory space. The available laboratory equipment includes all routine analytical equipment plus radiation counting equipment, gas-liquid chromatographs, a C-H-N analyzer, respirometers, four constant-temperature rooms, a clean room for aerosol work, grinding equipment for solid wastes, high-speed centrifuges, reverse osmosis and ultrafiltration pilot plant systems, an atomic absorption unit, a particle counter, UV-visible and infrared spectrophotometers, total organic carbon analyzer, a light-scattering photometer, plus equipment for sampling and measuring fluid flow, and facilities to conduct constant-flow bioassays. A large-scale pilot plant room is available, which has installed piping carrying domestic sewage and untreated ground water.

The Department has complete shop facilities for working with metals, wood, and plastics. It also has an instrument repair and electronics shop. Fully-equipped darkroom facilities are available.

The University's IBM 360/75 computer is accessible by means of a remote batch terminal (high-speed card reader, printer, and peripheral equipment) located in the Civil Engineering Building, and by means of time-sharing terminals through normal telephone equipment. A Burroughs 6700 computer is located in the Civil Engineering Building and may be used in special cases.

Illinois Institute of Technology

Chicago, Illinois

Department of Environmental Engineering
College of Engineering and Physical Sciences

Environmental Engineering
Environmental Chemistry
Environmental Biology

Dr. James W. Patterson, Chairman
Department of Environmental Engineering
Illinois Institute of Technology
3300 South Federal Street
Chicago, IL 60616
(312) 225-9600 x457

May 1973

The purpose of the graduate program in environmental engineering at Illinois Institute of Technology is to develop highly competent environmental engineers and scientists. The program is interdisciplinary and qualified students from chemical and civil engineering, chemistry, biology, and other appropriate engineering and science disciplines may enroll. Admission requirements with respect to undergraduate discipline are intentionally not rigid. This reflects the broad interdisciplinary talents appropriate to environmental engineering and science and allows particular knowledge developed through undergraduate education to be integrated into the graduate program of study. The Department of Environmental Engineering awards the MS and PhD degrees to candidates who successfully complete their respective programs. Major emphasis within the Department is upon the air and water environments with three program options available: environmental engineering, environmental biology, and environmental chemistry.

Illinois Institute of Technology is a privately-supported, independent, coeducational university. It offers undergraduate and graduate programs to over 3,000 full-time students in engineering, the physical and biological sciences, the social sciences and humanities, law, business management, design, architecture, and city and regional planning. Approximately one-half of the enrollment is at the graduate level. The University, with its research affiliates, ranks third among technological institutions in the nation in combined expenditures for education and research. Tuition and fees for full-time graduate study average $2,200 for an academic year.

IIT's campus is a world-famous architectural landmark. It is a complex of more than fifty modern buildings occupying a landscaped area of 120 acres. The campus has grown out of a basic plan prepared in the 1930s by the founder of IIT's School of Architecture and Planning, Ludwig Mies van der Rohe. The campus is located just three miles south of Chicago's loop amid two square miles of a newly-developed, modern urban area, and one mile from Lake Michigan.

Admission Requirements

(a) 3.0/4 for admission to MS or PhD study.

(b) GRE is not required.

(c) Provisional admission to MS is possible with GPA of 2.7/4 providing additional evidence of capabilities is submitted. Provisional status requires maintaining a minimum 3.0/4 GPA during graduate study.

(d) Foreign students must score a minimum of 450 on TOEFL. Newly-admitted non-US students may be required to take the "English Proficiency Review" at IIT during registration week.

(e) Any appropriate engineering or science discipline, such as biology, chemical engineering, chemistry or civil engineering, is acceptable.

(f) Application for admission to graduate study must include two letters of reference together with transcripts of all previous academic work.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	32S	Yes	No	0	16
PhD	64S	Yes	1	2S	30

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
EnvE 210	Man & His Environment	Letterman	-	S'74	12
EnvE 401	Intro. to Water Resources	Male	-	F'73	25
EnvE 402	Fundamentals of Water & Waste Treat.	Male & Obayashi	-	S'74	60
EnvE 410	Environmental Health Engineering	Letterman	-	S'74	31
EnvE 463	Intro. to Air Pollution Control	Aynsley	-	F'73	23
EnvE 501	Environmental Chemistry	Delfino	-	F'73	36
EnvE 502	Applied Environmental Chemistry	Allen	-	New'74	-
EnvE 503	Water & Waste Analysis	Schneiderman	-	S'74	23
EnvE 504	Advanced Tech. Environmental Analysis	Minear	-	F'71	11
EnvE 505	Principles of Water Chemistry	Minear	-	F'72	7
EnvE 509	Topics in Environmental Chemistry	Allen	-	New'74	-
EnvE 511	Ecological Aquatic Systems	Patterson	-	S'74	15
EnvE 512	Topics in Environmental Biology	Meyers	-	S'74	29
EnvE 513	Biochemical Engineering	Patterson	-	F'73	7
EnvE 525	Advanced Water Resources	Male	-	S'74	12
EnvE 528	Environmental Urban Systems	Male	-	New'74	-
EnvE 530	Systems Analysis of Water Resources	Male	-	New'74	-
EnvE 541	Physical Processes Treatment	Letterman	-	S'73	13
EnvE 543	Chemical Processes Treatment	Patterson	-	S'73	15
EnvE 551	Industrial Waste Treatment	Lagvanhar	-	F'73	23
EnvE 561	Design of Sanitary Processes	Graef	-	S'74	20
EnvE 575	Atmospheric Chemistry	Gutman	-	S'74	15

BI 421	General Microbiology	DuPont	-	F'73	35
BI 451	General Statistics	Tarver	-	F'73	38

EnvE 402 and 501 and BI 421 and 451 are required of all EnvE majors unless they have had previous equivalent course(s).

Faculty

JAMES W. PATTERSON
Associate Professor and Chairman, Department of Environmental Engineering and Director, Pritzker Environmental Studies Center
1970

BS	Auburn University	Civil Engineering	1964
MS	Auburn University	Sanitary Engineering	1967
PhD	University of Florida	Environmental Engineering	1970

Industrial pollution control, theory and practice of chemical treatment processes, biological functions in natural and engineered systems

100% (40% teaching, 30% research, 30% administration)

"Wastewater Treatment Technology," 2nd ed., Illinois Institute for Environmental Quality Document No. 73-1, 1973 (with R. A. Minear)

"Treatment of Metallic Wastewaters," Proceedings, Symposium on Water Pollution in Metropolitan Areas, 1972 (with R. A. Minear)

"Solid/Liquid Separation by Capillary Filtration," Proceedings, 27th Purdue Industrial Waste Conference, 1972 (with P. Levin)

"Activated Sludge ATP: Effects of Environmental Stress," Journal Sanitary Engineering Division, American Society of Civil Engineers, 47, 6, 1971 (with P. C. Brezonik)

"Measurement and Significance of Adenosine Triphosphate in Activated Sludge," Environmental Science and Technology, 4, 7, 1970 (with P. C. Brezonik and H. D. Putnam)

"Effluent Guidelines for the Inorganic Chemicals Industry," US Environmental Protection Agency, 6/72-6/73, principal investigator

"Industrial Pollution Control Technology Applications," The Marmon Group, 5/72-4/73, principal investigator

"Training Grant--Water Pollution Control," US Environmental Protection Agency, 9/71-12/73, project director

Previous full-time professional experience: 2 yrs. (government)

Member, AEEP
Member, Cook County Environmental Control Board of Appeals (1972-75)
Member, National Research Committee
Member, Water Pollution Control Federation (1971-date)
Consultant, Federal Power Commission (1973-date)

HERBERT E. ALLEN
Assistant Professor
Department of Environmental Engineering
1974

BS	The University of Michigan	Chemistry	1962
MS	Wayne State University	Chemistry	1967
PhD	The University of Michigan	Environmental Chemistry	1974

Chemistry of aquatic systems, nutrients and their effect on receiving waters, environmental chemical analyses

100% (70% teaching, 30% research)

"The Significance of Physico-chemical Variables in Aquatic Bioassays of Heavy Metals," in Bioassay Techniques and Environmental Chemistry, Ann Arbor Science Publishers, Inc. (et al.)

"The Control of pH and Total Alkalinity or Total Carbonate in Aquatic Bioassays," Trans. American Fisheries Society, 101 (with R. F. Roberts)

"Phosphorus: Analysis of Water, Biomass and Sediment," in Nutrients in Natural Waters, John Wiley Sons, Publishers (with J. R. Kramer and S. E. Herbes)

Nutrients in Natural Waters, John Wiley Sons, Publishers (with J. R. Kramer, eds.)

"Design of Measurement Systems for Water Analysis," in Chemical Analysis in Water and Water Pollution, Marcel Dekker Publisher (with K. H. Mancy)

"Chemistry of Heavy Metals in Natural Waters," National Institute of Health, Department of Health, Education and Welfare, 3/1/71-8/31/72, co-investigator

"Nutrient Dynamics in Natural Waters," Rockefeller Foundation, 4/1/71-12/31/71, co-investigator

"Effects of Land Disposal of Sewage on the Water Resources of Muskegon," US Environmental Protection Agency, 7/1/72-6/30/74, co-investigator

Previous full-time professional experience: 12 yrs. (8 yrs. government and 4 yrs. academic)

Member, Water Pollution Control Federation; Member, Research Committee (1972-date)
Consultant, World Health Organization (1969-date)

RAYMOND D. LETTERMAN
Assistant Professor
Department of Environmental Engineering
1971

BA	Lehigh University	Arts and Science	1966
BS	Lehigh University	Civil Engineering	1967
MS	Northwestern University	Civil Engineering	1969
PhD	Northwestern University	Civil Engineering	1972

Physical-chemical processes of water and wastewater treatment, environmental health, water resource planning

100% (70% teaching, 30% research)

"Coagulation of Activated Carbon Suspensions," Journal American Water Works Association, 62, 4, 1970 (with J. E. Quon and R. S. Gemmell)

"Impact of the Sewer Connection Ban on Biochemical Oxygen Demand and Suspended Solids at the North Shore Sanitary District," Report to the State of Illinois, Institute for Environmental Quality, March 1972 (with N. Drummond)

"Treatment of Lake Michigan Water Using Contact Flocculation," Office of Water Resources Research, 7/73-6/74, principal investigator

Member, AEEP
Member, Water Pollution Control Federation
Member, American Society of Civil Engineers
Member, American Water Works Association
Member, Illinois Section, American Water Works Association; Member, Students' Activities Committee (1972-date)
Consultant, Environmental Studies Center, Argonne National Laboratory (1972-date)

JAMES W. MALE
Assistant Professor
Department of Environmental Engineering
1973

BS	Union College	Civil Engineering	1968
PhD	The Johns Hopkins University	Environmental Engineering	1973

Operations research and systems analysis applications in environmental control, process optimization including solid waste collection routing and disposal

100% (75% teaching, 25% research)

"A Mathematical Model for Determining Case Finding and Treatment Activities in Tuberculosis Programs," American Review of Respiratory Diseases, 102, 1970 (with C. ReVelle)

DAVID R. ZENZ
Adjunct Assistant Professor
Department of Environmental Engineering
1969

BS	Illinois Institute of Technology	Civil Engineering	1965
MS	Illinois Institute of Technology	Environmental Engineering	1967
PhD	Illinois Institute of Technology	Environmental Engineering	1969

Industrial and domestic waste treatment processes, advanced and tertiary treatment technology

35% (25% teaching, 10% research)

"Effective Phosphorus Removal by the Addition of Alum to the Activated Sludge Process," Proceedings, 24th Purdue Industrial Waste Conference (with J. Tiunicka)

ERIC AYNSLEY
Lecturer (Part-time)
Department of Environmental Engineering

ScD	University of Birmingham, England	Chemical Engineering	1965

Air pollution sources, effects and control technology; thermal pollution and waste heat utilization
30%

STEVEN P. GRAEF
Graduate Lecturer (Part-time)
Department of Environmental Engineering

PhD	Clemson University	Environmental Systems Engineering	1972

Plant operations, biological wastewater treatment processes, process stability and control, computer applications to process design and operation
30%

C. DONALD MEYERS
Graduate Lecturer (Part-time)
Department of Environmental Engineering

PhD	The Johns Hopkins University	Environmental Biology	1973

Aquatic ecology, diagnosis and management of environmental problems in aquatic systems, thermal pollution impacts and controls
30%

ALAN W. OBAYASHI
Graduate Lecturer (Part-time)
Department of Environmental Engineering
PhD Oklahoma State University Bioenvironmental Engineering 1972
Municipal and advanced wastewater pollution abatement, treatment plant design and operation
30%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental	Master's	-	-	8	10	16	14	16	20	27	31	ENROLLMENT
Engineering	Doctoral	-	-	3	0	4	0	6	0	7	0	

		69-70	70-71	71-72	72-73	73-74	
Environmental	Master's	-	2	4	7	17	GRADUATES
Engineering	Doctoral	-	1	1	2	2	

Environmental	Master's	4	NON-US NATIONALS
Engineering	Doctoral	3	

	Master's	Doctoral	
EPA traineeship	6	0	SUPPORT
Other traineeship	1	0	
Research assistantship	3	0	
Teaching assistantship	2	2	
Other university support	0	1	
Foundation support	1	0	
Industrial employer	0	2	
Government employer	0	1	
Self-supported	3	0	

Facilities

The environmental engineering facilities include air conditioned teaching and research laboratories plus student and staff office space in Alumni Memorial Hall. An additional fully-equipped, air conditioned laboratory, plus a workshop and student offices, are located in the nearby Wabash Building. The recently occupied Alumni Hall facilities have been the result of a major expansion of departmental activities during the last several years.

In addition to the campus facilities described above, the department has a 40-foot air conditioned mobile environmental laboratory which is completely self-contained and equipped for standard air and water environmental analyses. The unit is employed in summer training projects and on-site field analyses for course and research activities.

The environmental engineering laboratories are well equipped for both teaching and research. The Alumni Hall laboratory contains three 6'x12' stainless steel constant temperature rooms plus major research and teaching equipment. The Wabash facility contains a pilot plan unit operations laboratory for teaching and research. Recent acquisitions include a Technicon Auto-Analyzer, a Varian 1740 dual column gas chromatograph with linear temperature programmer, dual flame ionization detectors plus electron capture and alkali flame phosphorus detectors and a Varian AA120 Atomic Absorption Spectrophotometer with carbon furnace.

Extensive research facilities are also available at Argonne National Laboratories, located twenty-five miles from the Chicago campus. Student research and travel funds are available through Argonne. The close proximity of this facility greatly enhances research capabilities for environmental projects.

University of Iowa

Iowa City, Iowa

Environmental Engineering Program
College of Engineering & College of Medicine

Environmental Engineering

Dr. Wayne L. Paulson, Director
Environmental Engineering Program
203 Water Plant
University of Iowa
Iowa City, IA 52242
(319) 353-5181

February 1974

The environmental engineering program awards MS and PhD degrees with majors in air and water quality management, solid wastes management, and general environmental engineering. Most students pursue the water quality option which is the most extensive course and research area. Students with nonengineering BS degrees may pursue a water quality science option. A joint major in water resources engineering with the Mechanics and Hydraulics Department is available.

The University of Iowa is state supported with a total enrollment of approximately 20,000 students of which 25 percent are graduate students. There are ten colleges: Liberal Arts, Graduate, Business Administration, Medicine, Engineering, Law, Nursing, Pharmacy, Dentistry, and Education. Our faculty and students actively cooperate in research and study with several areas, including the College of Medicine, College of Law, Institute of Hydraulic Research (water resources), and the Chemical and Materials Engineering Department. Tuition and fees for full-time graduate students are $710 (resident) and $1200 (nonresident) for the academic year. Nonresident students with one-fourth time appointments pay resident rates.

The 900-acre campus spans the Iowa River valley and merges with Iowa City, a community of 50,000 near Cedar Rapids, Iowa's second largest city. The University is well known for its fine arts program and offers a full range of cultural activities. The University is a member of the Big Ten and also offers a wide range of indoor and outdoor recreational opportunities.

Admission Requirements

(a) 2.5/4 for MS and 3.2/4 for PhD.

(b) A GRE score is only used for conditional admissions at MS level. A combined score of 1000 is required for GPA's between 2.3 and 2.5.

(c) Admission to the MS program is possible with GPA of 2.3/4. Students must obtain a 2.7/4 GPA to obtain regular status.

(d) Foreign students must score a minimum of 480 total on the TOEFL test to be admitted.

(e) All engineering and engineering science disciplines are acceptable for admission to the engineering options. Nonengineering undergraduate majors may pursue the science option or by completing appropriate undergraduate engineering courses enroll in the engineering options.

(f) Nonengineers are required to have completed calculus and have adequate background in statistics and computer science to be admitted to the science option. Those students considering the engineering majors must complete background course work in fluid mechanics, flow systems, and environmental engineering.

(g) An MS degree in environmental engineering is considered a prerequisite for the PhD program. Letters of reference are also required for the PhD program.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.[a]	30S	Yes	No	24S	12
MS--Envir. Engr.	30S	Optional	No	24S	12
PhD--Envir. Engr.	72S	Yes	No	12 mos.	36

[a] Science major.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
151	Environmental Microbiology	McDonald	3S	F'73	16
152	Environmental Toxicology	McDonald	3S	F'73	12
155	Environmental Health	Powell	3S	F'73	10
156	Environmental Chemistry I	Paulson McMullen	3S	F'73	19
157	Environmental Chemistry II	McMullen	3S	S'73	12
161	Principles of Environmental Engineering	Paulson Tracy	3S	S'73	43
162	Environmental Design	Tracy McMullen	3S	F'73	10
163	Environmental Engineering I: Systems	Tracy Paulson	4S	F'73	10
164	Environmental Engineering II: Design	Paulson Tracy	3S	S'73	8

165	Environmental Engineering III: Air Pollution & Solid Wastes	Powell Mashaw	3S	F'73	9
166	Air Pollution Control Technology	Dague	3S	F'71	7
167	Solid Waste Technology	Mashaw	3S	S'73	6
168	Limnology	McDonald	3S	S'73	15
250	Seminar: Environmental Engineering	Powell	1S	F'73	20
257	Environmental Chemistry III	McMullen Paulson	2S	F'73	6
263	Environmental Engineering IV: Systems Lab	Tracy & Staff	2S	S'73	8
267	Industrial Water Quality Control	Paulson Tracy	3S	Su'73	8
268	Applied Limnology	McDonald	2S	Su'73	3
269	Environmental Engineering Systems: Special Topics	McMullen Powell	2S	Su'73	8
Hyd-111	Hydrology	Croley	3S	F'73	12
ChE 230	Meterological Aspects--Air Pollution	Vetter	2S	S'73	6
Hyd-116	Water Resources Systems	Croley	3S	F'73	10
Geo 166	Geohydrology	Steinhilber	3S	S'73	12
IE 141	Intro-Operations Research	Beenhakker	3S	F'73	20
ChE 120	Reaction Kinetics	Tock Osburn	2S	S'73	10
Law 136	Resource Planning	Hines	3S	S'73	50

CE 156, 163 and 250 are required of all engineering majors. Additional option requirements: water quality (151, 157, 164 and 263); solid wastes (165, 167, IE 141, Law 136 plus a management course); air quality (152, 165, 166 and 230). Science majors complete 10S of engineering courses plus selected courses from applied chemistry and biology.

Faculty

WAYNE L. PAULSON
Professor and Director
Environmental Engineering Program
Civil Engineering Department
1960

BS	University of Wisconsin-Madison	Civil Engineering	1959
MS	University of Wisconsin-Madison	Sanitary Engineering	1960
PhD	University of Iowa	Environmental Engineering	1965

Water quality control systems, activated sludge process, oxygen transfer, lake and river water quality

100% (40% teaching, 35% research, 25% administration)

"Full Scale Parallel Process Evaluation for Activated Sludge Systems," Journal Water Pollution Control Federation, accepted in 1973 (with E. D. Toerber and H. S. Smith)

"Analysis of Wastewater Treatment Systems for Packinghouse Wastes," Proceedings, 27th Purdue Industrial Waste Conference, May 1972 (with L. Lively and J. Witherow)

"Jet Aeration in Activated Sludge Systems," Journal Water Pollution Control Federation, October 1969 (with R. West)

"Engineering and Science of Water Quality Management," US Environmental Protection Agency, 7/70-date, director

"Systems Analysis Applied to the Protection and Enhancement of the Water Quality of Lake MacBride," Office of Water Resources Research, 7/73-6/76, principal investigator

"Full Scale Parallel Process Evaluation for Activated Sludge Systems--Freeport, Illinois," US Environmental Protection Agency, 1/70-3/72, process consultant

Registered professional engineer: Iowa

Member, AEEP
Member, Executive Council, Iowa State Water Resources Research Institute (1970-date)
Consultant, Wastewater Treatment Demonstration Projects, US Environmental Protection Agency (1970-date)

DONALD B. McDONALD
Professor, Environmental Engineering Program
Civil Engineering Department
1962

BS	University of Utah	Biology	1954
MS	University of Utah	Zoology/Ecology	1956
PhD	University of Utah	Limnology/Bacteriology	1962

Applied limnology; lake, reservoir, and stream studies; environmental impact (thermal); pesticides; taste and odor

100% (45% teaching, 55% research)

"Effects of a Flood Control Reservoir on Water Quality," Water and Sewage Works, November 1967 (with R. D. Schmickle)

"Cedar River Baseline Ecological Study--Duane Arnold Energy Center," Report, Iowa Electric Light and Power, June 1972

"Environmental Assessment of the Proposed Twelve-Foot Navigation Channel on the Upper Mississippi River," Report to Corps of Engineers, August 1973 (with M. McDonald)

"The Effect of Photosynthesis on the Oxygen Balance in a Midwestern Stream," Proceedings, Purdue Industrial Waste Conference, 1968

"The Effect of the Coralville Reservoir on Water Quality," Corps of Engineers, 1964-date, principal investigator

"Environmental Impact Study of Duane Arnold Nuclear Energy Center," Iowa Electric Light and Power, 1970-date, principal investigator

"Environmental Impact Study--Twelve-Foot Navigation Channel on the Upper Mississippi River," Corps of Engineers, 1972-73, principal investigator

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KENNETH D. TRACY
Assistant Professor, Environmental Engineering Program
Civil Engineering Department
1973

BS	Pennsylvania State University	Civil Engineering	1964
MS	Pennsylvania State University	Sanitary Engineering	1966
PhD	Clemson University	Environmental Systems Engineering	1973

Process modeling for water quality control, assessment of impact of waste discharges on the natural environment

100% (60% teaching, 40% research)

"Dynamic Model for Thickening of Activated Sludge," presented at the 74th National Meeting, American Institute of Chemical Engineers, New Orleans, March 1973 (with T. M. Keinath)

"Unsteady-State Thickening of Compressible Slurries: Simulation and Experimental Verification," presented at the 46th Annual Conference, Water Pollution Control Federation, Cleveland, October 1973 (with T. M. Keinath)

Previous full-time professional experience: 3 1/2 yrs. (government)

MARCUS P. POWELL
Associate Professor
Preventive Medicine, Environmental Health and Environmental Engineering
1938

BS	Iowa State College	Dairy Science	1934
BS	University of Iowa	Hygiene and Industrial Hygiene	1941
MS	University of Iowa	Civil Engineering	1942

Environmental health, water and wastewater plant operation, water treatment

100% (65% teaching, 25% administration, 10% research)

"Wastewater Works Operator Training," Iowa Water Pollution Control Association Anniversary Brochure, 1969

"Water Quality Changes Due to Impoundment," Journal American Water Works Association, 59, 289, 1967 (with P. M. Berthouex)

Registered professional engineer: Iowa

Bedell Award, Water Pollution Control Federation (1964)
Water Works Man of the Year Award, American Water Works Association (1968)
Fellow, American Public Health Association
Chairman, Iowa Certification Board Water and Wastewater Plant Operators (1965-date)

LEE D. McMULLEN
Instructor
Preventive Medicine, Environmental Health and Environmental Engineering
1971

BS	University of Iowa	Civil Engineering	1968
MS	University of Iowa	Environmental Engineering	1972
PhD Candidate	-	-	1972-date

Environmental chemistry, river and lake water quality studies, systems analysis, statistical application

100% (60% teaching, 40% research)

"Upper Iowa River Water Quality Study," Iowa Academy of Science Paper, April 1973

"Systems Analysis Applied to the Protection and Enhancement of the Water Quality of Lake MacBride," Office of Water Resources Research, 7/73-6/76, project supervisor

Registered professional engineer: Engineer-in-Training, Iowa

Previous full-time professional experience: 2 yrs. (government)

NEIL B. FISHER
Assistant Professor, Environmental Engineering Program
Civil Engineering Department
1954

BS	University of Iowa	Civil Engineering	1951
MS	University of Iowa	Sanitary Engineering	1954

Water treatment processes, solids contact process, filtration

10% (research)

"Algal Removal in Unit Processes," Journal American Water Works Association, 61, 6, June 1969 (with R. Speedy and D. B. McDonald)

"Solids Concentration and Performance of Solids Contact Softeners," Journal American Water Works Association, 60, 5, May 1968 (with R. Kross and W. L. Paulson)

Registered professional engineer: Iowa

Previous full-time professional experience: 12 yrs. (government)

President, Iowa Water Pollution Control Association (1970)

LANE H. MASHAW
Associate Professor
Civil Engineering Department
1966

BS	University of Illinois	Civil Engineering	1946
MS	University of Iowa	Civil Engineering	1966

Solid waste management, public works, flow systems, assessment methods

30% (25% teaching, 5% research)

"The Civil Engineering Student Views Public Works," Public Works, March 1970 (with J. Smith)

"Public Relations--A Self Analysis," Journal Water Pollution Control Federation, 42, March 1970

"A Public Works Director--For Free," Nation's Cities, October 1968

"Solid Waste Management," US Environmental Protection Agency, 7/71-6/74, project director

"Engineering and Legal Aspects of Special Assessments--Storm Water Systems," Office of Water Resources Research, 1971-73, principal investigator

Registered professional engineer: Iowa and Illinois

Previous full-time professional experience: 18 yrs. (9 yrs. government and 9 yrs. consulting)

Member, Institute of Solid Wastes, American Public Works Association
Member, American Society for Engineering Education; Member, Committee for Teaching Methods and Technical Areas

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JAMES O. OSBURN
Professor
Chemical Engineering Department

PhD	University of Michigan	Chemical Engineering	1944

Reaction kinetics, reverse osmosis
5%

ARTHUR F. VETTER
Associate Professor
Chemical Engineering Department

PhD	University of Illinois	Nuclear Engineering	1974

Nuclear energy, meterology--air pollution
5%

JOSE E. RODRIGUEZ
Assistant Professor
Microbiology Department

PhD	Pennsylvania University	Microbiology	1963

Virology
5%

JOHN F. KENNEDY
Director, Institute for Hydraulic Research
PhD California Institute of Technology Hydraulics 1961
Environmental dispersion, thermal release, sediment transport
10%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	12	2	10	2	14	2	19	2	12	2	ENROLLMENT
	Doctoral	4	0	4	0	4	0	3	0	3	0	
Environmental Science	Master's	2	0	2	0	3	0	8	1	5	0	
	Doctoral	1	0	0	0	1	0	1	0	1	0	

		68-69	69-70	70-71	71-72	72-73	
Environmental Engineering	Master's	9	3	7	11	6	GRADUATES
	Doctoral	1	0	1	1	0	
Environmental Science	Master's	0	1	1	6	2	
	Doctoral	0	0	0	0	0	

Environmental Engineering	Master's	0	NON-US NATIONALS
	Doctoral	1	
Environmental Science	Master's	0	
	Doctoral	0	

	Envir. Engr.		Envir. Science		
	Master's	Doctoral	Master's	Doctoral	
EPA traineeship	9	0	3	0	SUPPORT
Research assistantship	2	2	2	1	
Teaching assistantship	1	0	0	0	
Other university support	0	1	0	0	
Government employer	1	0	0	0	
Consultant employer	1	0	0	0	
Consulting	36	67	10	0	EMPLOYMENT (%)
Industry	14	0	10	0	
Federal government	11	0	0	0	
Other government	28	0	30	0	
Academic	3	33	20	0	
Further study	8	0	30	0	

Facilities

Research and teaching laboratory facilities are located in the P. F. Morgan Laboratory (2000 sq ft) and the 4 mgd University Water Plant (4500 sq ft). The Morgan Laboratory is located on the 8 mgd City-University Wastewater Treatment Plant grounds. This laboratory is specially equipped for pilot plant projects and contains a full-scale 10,000 gallon aeration tank and a 500 gpd activated sludge pilot plant. The University Water Treatment Plant is specially designed and instrumented for full-scale research. Complete limnological field sampling equipment and associated laboratory instrumentation is available at the water plant.

Iowa State University of Science and Technology

Ames, Iowa

Department of Civil Engineering
Water Resources Interdepartmental Advisory Committee
College of Engineering

Sanitary Engineering
Water Resources

Dr. E. Robert Baumann
Professor-in-charge
Environmental Engineering Section
Department of Civil Engineering
Iowa State University
496 Town Engineering Building
Ames, IA 50010
(515) 294-4975

May 1973

The environmental engineering section conducts a graduate program designed to give each engineering student a broad understanding of the entire field of water resources, yet provide opportunity for specialization in water supply and pollution control and water resources. Each engineering student completes a core of courses in quality-quantity aspects of water supply and pollution control required for all areas of specialization. In addition to the water supply and pollution control core, each student completes additional work to emphasize his specialization. Water supply and pollution control students will elect additional course work in chemistry, microbiology, limnology, etc. Water resources students elect additional course work in hydrology, hydraulics, fluid mechanics, economics, etc. The student may enter a research-oriented program leading to MS and PhD degrees in sanitary engineering or may enter a professional-oriented program leading to the degree ME in sanitary engineering.

Nonengineering students may enter an Interdisciplinary Program in Water Resources and complete an MS or PhD in water resources under the supervision of a professor in the environmental engineering section of the Department of Civil Engineering. Fundamental and applied research is conducted in such areas as source, distribution and movement of water; hydraulics of water control facilities; physical, chemical and biological properties of water; and social-economic-legal aspects of water resources development.

Iowa State University is a land-grant institution (the first in the United States) with a total academic year enrollment of 21,700 (3,400 in engineering and 3,300 in the graduate college). The Iowa State Water Resources Research Institute, the US Animal Disease Lab, the Ames Laboratory of the Atomic Energy Commission, the Hach Chemical Company, and the General Filter Company are all located in Ames. The engineering college is the largest west of the Mississippi River and ranks in the top 20 in graduate engineering degrees awarded nationally. Tuition and fees in the graduate college calendar year range from $1,640 (nonresident) to $940 (resident) to $480 (with graduate teaching or research assistant appointment).

Iowa State University is located in Ames, a city of 42,000, and is about 35 miles from Des Moines, the state capitol with a metropolitan population of 300,000. The university-operated student housing is available in several price ranges. The University is located in a rural-urban area.

Admission Requirements

(a) 2.65/4 for Master's; 2.8/4 on undergraduate work or 3.2/4 for Master's level work for PhD.

(b) GRE is not required, but is given serious consideration if scores are presented. In general, combined scores above 1050-1100 will enhance admission potential.

(c) All foreign students and students with GPA below 2.65/4 may be admitted on a restricted basis until they demonstrate ability to complete a graduate program with satisfactory grades, greater than 3.0/4. Students with satisfactory engineering experience after their undergraduate degree may be considered for full or restricted admission with GPA of about 2.5-2.65/4.

(d) Foreign students must submit evidence of English language proficiency as evidenced by any one of the following minimum test scores: TOEFL--500, ALIGU--70%, Michigan Language Test--80% or ISU Language Test--Pass.

(e) Candidates for graduate degrees in sanitary engineering are accepted if they have undergraduate degrees in some field of engineering. Nonengineering students with undergraduate degrees in science areas (geology, chemistry, physics, etc.) may be awarded a graduate sanitary engineering degree only if they complete, without graduate credit, mathematics through differential equations, basic work in statistics and computer programming, mechanics courses in statics, dynamics, strength of materials and fluids. Nonengineering students with degrees in science (economics, geology, chemistry, soil-physics, etc.) are accepted by environmental engineering professors for study in the interdisciplinary water resources degree program. Such students do not receive the sanitary engineering degree.

(f) All candidates for graduate sanitary engineering degrees are required to take the following prerequisites: mechanics of fluids, hydrology, water and wastewater treatment, design of water supply and sewer systems, design of sanitary engineering systems (optional) and principles of biology or environmental biology.

(g) Foreign students must submit evidence of having been awarded a "first class" (India) degree or an overall four-year average of 76-78 (Taiwan).

(h) Applicants for PhD study must have three letters of recommendation submitted from former professors who have knowledge concerning the applicant's capacity for productive research. One such letter must be submitted from the professor in charge of his Master's research. Doctoral candidates are expected to have above average academic performance at the Master's level and must demonstrate significant capacity for original, creative research potential.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Sanitary Engineering	45Q[b]	Yes	No	33 cr	12
ME--Sanitary Engineering	45Q[a,b]	Optional	No	33 cr	12
MS--Water Resources[d]	45Q[a]	Optional	No	33 cr	12
PhD--Sanitary Engineering[c]	108Q+[b]	Yes	Yes	54 cr	24
PhD--Water Resources[d]	108Q+	Yes	Yes	54 cr	24

[a] If nonthesis option is chosen, 52Q credits are required.

[b] At least 13Q must be taken outside the Civil Engineering Department.

[c] At least one minor area of specialization is usually required in addition the major.

[d] Special requirements on number of credits of minor work in hydrology, hydraulics, water quality, and social-economic areas.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 228[1]	Sanitary Engr. in Envir. Control	Morgan Baumann Young	-	F'72	7
CE 304[1]	Hydrology	Dougal	-	S'72	12
		Austin	-	W'73	27
		Rossmiller	-	S'73	68
CE 325[1]	Water & Wastewater Treatment	Young	-	F'72	26
		Austin	-	F'72	28
		Cleasby	-	F'72	31
		Oulman	-	F'72	23
CE 426[1]	Design of Water Supply & Sewer Systems	Young	-	W'73	44
		Oulman	-	F'72	24
CE 427[1]	Design of Sanitary Engr. Systems	Baumann	-	S'73	16
CE 472[1]	Applied Hydraulic Design	Dougal	-	S'73	17
CE 505	Public Works Engineering	Morgan	-	S'71	12
CE 520	Water & Wastewater Analyses	Oulman	-	W'73	14
CE 522	Water Pollution Control Plant Design	Cleasby	-	S'73	7
CE 523	Water Treatment Plant Design	Cleasby	-	W'73	9
CE 524X	Solid Waste Disposal	Young	-	S'73	7
CE 525	Adv. Treatment of Water & WW	Oulman	-	S'73	9
CE 528	Fund. of Biological Waste Treatment	Young	-	F'73	13
CE 529	Low-Level Radioactive Wastes	Oulman	-	-	-
CE 571	Field Hydrology	Dougal	-	F'73	10
CE 573	Groundwater Hydrology	Dougal	-	S'73	8
CE 574	Multiple Use of Water Resources	Austin	-	W'73	8
CE 590	Special Topics	Staff	-	-	22
CE 622	Adv. Topics in Water Pollution Control	Cleasby Baumann	-	F'72	6
CE 623	Adv. Topics in Water Treatment	Baumann Cleasby	-	F'71	8
CE 671	Adv. Topics in Resources Engineering	Dougal Johnson	-	F'72	11
CE 699	Research	-	-	-	-
WR 501	Water Resources I	Austin	-	F'72	15
WR 502	Water Resources II	Baumann	-	W'73	19
WR 503	Water Resources III	-	-	S'73	20
AgEngr 424	Hydraulic Design of Soil & Water Control Facilities	Johnson	-	W'73	10
AgEngr 471	Principles of Livestock Waste Mgt.	Smith	-	S'73	17
AgEngr 524	Erosion & Sediment Transport	Johnson	-	F'72	7
AgEngr 526	Frequency Distribution in Hydrologic Data	Beer	-	W'73	6
Bacti 300[1]	Introductory Bacteriology	Staff	-	S'73	-
Food Tech 414	Food, Milk, & Water Sanitation	Walker	-	S'73	-
Bacti 601 602 603	Adv. Bacteriology	Staff	-	S'73	-
Biochem & Biophysics 301	Survey of Biochemistry	Staff	-	S'73	-
Biochem & Biophysics 304,305	Physiological Chemistry	Staff	-	FW'73	-
Botany 500	Biology of Algae	Dodd	-	F'72	-
ChemE 351	Multistage Operations	Staff	-	F'72	55
ChemE 352	Momentum Transport Operations	Staff	-	W'73	59
ChemE 353	Energy Transport Operations	Staff	-	S'73	66
ChemE 211[1]	Quantitative Analysis	Staff	-	S'73	-
Chem-334,335	Organic Chemistry	Staff	-	FWS-72-73	-
Chem 524	Surface Chemistry	Staff	-	W'73	-
Earth Sci. 535	Groundwater Geology	Sendlein	-	W'73	-
Econ 480	Natural Resource Economics	Staff	-	W'73	-
EngrSci Mechanics 571, 572,573	Adv. Fluid Mechanics	Young	-	FWS'72-73	-

EngrSci 484	Principles of Similtude	Staff	-	FS-72-73	-
IndEngr 504	Adv. Engineering Economy	Staff	-	FWS-72-73	-
Statistics 401 402	Statistical Methods for Research Workers	Staff	-	FWS-72-73	-
Zoology 405	Fundamentals of Limnology	Bachmann	-	S'73	-

[1] No graduate credit.

Chem 211 and 334; CE 520, 522, 523, 525, and 528; and Biol 101 or 103 are required of all sanitary engineering degree candidates.

Chem 211 and 334; CE 325, 426, 520, 525 and 528; and WR 501, 502, and 503 are required of all water resources degree candidates with an environmental engineering professor as advisor.

Faculty

E. ROBERT BAUMANN
Anson Marston Distinguished Professor of Engineering
Department of Civil Engineering
1953

BSE	University of Michigan	Civil Engineering	1944
BS	University of Illinois	Sanitary Engineering	1945
MS	University of Illinois	Sanitary Engineering	1947
PhD	University of Illinois	Sanitary Engineering	1954

General water supply and pollution control process research with major emphasis on water and wastewater filtration through diatomite and dual-media filters

100% (45% teaching, 45% research, 10% administration)

Sewerage and Sewage Treatment, 8th ed., John Wiley and Sons, New York, 1958 (with H. E. Babbitt)

"Polyelectrolyte Coatings for Filter Media," Filtration and Separation, 7, 6, p. 682-690, November/December 1970 (with C. S. Oulman)

"Diatomite Filters for Municipal Use," Journal American Water Works Association, 57, 2, p. 157-180, February 1965 (Task Group Report)

"Selection of Sand Filtration Rates," Journal American Water Works Association, 54, 5, p. 579-602, May 1962 (with J. L. Cleasby)

"Effect of Preaeration on the Primary Treatment of Sewage," Journal Water Pollution Control Federation, 33, 4, p. 339-355, April 1961 (with H. F. Seidel)

"Preimpoundment Studies of Water Quality, Des Moines River, Iowa," Corps of Engineers, 1967-75, principal investigator

"Ames Reservoir Environmental Study," Corps of Engineers, 1972-73, principal investigator--urban influences on water quality

"Advanced Wastewater Treatment by Multi-Media Filtration," Engineering Research Institute, continuous, principal investigator

Registered professional engineer: Illinois, Iowa, and Tennessee

Previous full-time professional experience: 4 yrs. (3 1/2 yrs. government and 1/2 yrs. industry)

Member, AEEP
Diplomate, AAEE
President, Association of Environmental Engineering Professors (1969, 1970); Vice President (1968); Director (1965-70); Secretary-Treasurer (1966-67)
Member, National Society of Professional Engineers; National Director (1964-68)
Member, American Water Works Association; Chairman, T & P Research Committee (1970-date); Chairman, Diatomite Filtration Committee (1963-date); Member, General Policy Council (1972-date); Member, T & P Council (1971-date); Fuller Award (1973); Iowa Section Chairman (1965)

Member, American Society of Civil Engineers; Chairman, Sanitary Engineering Research Committee (1963-68); Assistant Editor, Newsletter (1962-72); Awards Committee, Sanitary Engineering Division (1963-68)
Member, Iowa State Water Resources Research Institute (1965-date)

JOHN L. CLEASBY
Professor
Department of Civil Engineering
1954

BS	University of Wisconsin	Civil Engineering	1950
MS	University of Wisconsin	Civil (Sanitary) Engineering	1951
PhD	Iowa State University	Sanitary Engineering	1960

General water and wastewater treatment process research, especially filtration, softening, biological treatment, disinfection, and sedimentation

100% (50% teaching, 50% research)

Water Supply Engineering, 6th ed., McGraw-Hill, New York, 1962 (with H. E. Babbitt and J. G. Doland)

"Selection of Sand Filtration Rates," Journal American Water Works Association, 54, p. 579-602, 1962 (with E. R. Baumann)

"Effect of Backwash on Filter Effluent Quality," Journal Sanitary Engineering Division, American Society of Civil Engineers, 92, SA1, p. 215-228, February 1966 (with R.L. Johnson)

"Prediction of Filter Performance," Journal Sanitary Engineering Division, American Society of Civil Engineers, 94, SA6, p. 1043-1069, December 1968 (with Kou-ying Hsiung)

"Approaches to a Filtrability Index for Granular Filters," Journal American Water Works Association, 61, p. 372-381, August 1969

"Backwash of Granular Filters Used in Wastewater Filtration," US Environmental Protection Agency, 1971-date, principal investigator

"Design Requirements of Municipal Diatomite Filters," National Institute of Health and US Environmental Protection Agency, 1964-70, co-investigator

Registered professional engineer: Wisconsin and Iowa

Previous full-time professional experience: 3 yrs. (2 yrs. consulting and 1 yr. industry)

Member, AEEP
Member, American Society of Civil Engineers; Secretary, Environmental Engineering Division (1969-73)
Consultant, Pan American Health Organization Sanitary Engineering Design Course, Paraguay (Summer 1972); Consultant for World Bank (Summer 1972)
Consultant, Pan American Health Organization Water Treatment Plant Design, Brazil (Summer 1973)

PAUL E. MORGAN
Professor and Associate Dean of Engineering
Department of Civil Engineering
1953

BS	Iowa State University	Civil Engineering	1944
MS	Iowa State University	Sanitary Engineering	1956

Water and wastewater treatment, solid wastes, municipal and public works administration

25% (teaching)

"Analysis of Synthetic Unit Graphs," Journal Hydraulics Engineering Division, American Society of Civil Engineers, September 1962 (with S. M. Johnson)

"Trickling Filters Successfully Treat Milk Wastes," Journal Sanitary Engineering Division, American Society of Civil Engineers, August 1957 (with E. R. Baumann)

"Interdistrict Apportionment of Flood Control Costs," Journal Irrigation and Drainage Division, American Society of Civil Engineers, December 1968 (with R. R. Dague and E. R. Baumann)

Registered professional engineer: Iowa

Previous full-time professional experience: 9 yrs. (2 yrs. consulting, 5 yrs. government, and 2 yrs. military)

Member, National Society of Professional Engineers; National Director (1968-71)
Member, Iowa Engineering Society; President (1969)

MERWIN D. DOUGAL
Associate Professor
Department of Civil Engineering
1962

BS	Iowa State University	Civil Engineering	1956
MS	University of Iowa	Hydraulics/Hydraulic Engineering	1958
PhD	Iowa State University	Sanitary Engineering/Water Res.	1969

Water resources management, multiple use of water resources, surface water and groundwater hydrology, water quality in streams

100% (50% teaching, 50% research)

Flood Plain Management--Iowa's Experience, Iowa State University Press, Ames, 1969 (ed. with contributor)

"Flood Plain Regulation in Iowa," (Chapter 11) in Papers on Flood Problems (G. F. White, ed.), University of Chicago, Department of Geography, Research Paper No. 70, 1961 (with W. E. Akin)

"Economics of Water Quality," Proceedings, International Conference on Water for Peace, 6, p. 667-678, 1967 (with John F. Timmons)

"Mathematical Models for Expressing the Biochemical Oxygen Demand in Water Quality Studies," Proceedings, American Water Resources Association, 1967 (with E. R. Baumann)

"Physical and Economic Factors Associated with the Establishment of Stream Water Quality Standards," Completion Report, ERI 64400, Engineering Research Institute and Iowa State Water Resources Research Institute, 1970 (with E. R. Baumann and J. F. Timmons)

"Ames Reservoir Environmental Study," Corps of Engineers, 1972-73, project director

"Stream Water Quality Standards," Iowa State Water Resources Research Institute, 1966-70, project director

"Hydrology of Intermediate-Size Watersheds," Iowa Natural Resources Council, 1968-70, project director

Registered professional engineer: Iowa

Previous full-time professional experience: 5 yrs. (government)

Appointed by Governor of Iowa to Iowa Natural Resources Council for a six-year term
Appointed to Advisory Council to Story County Conservation Board (1969-72)
Member, American Society of Civil Engineers; Chairman, District 16 Council (1961-62), Member (1960-61); Chairman, Hydraulics Division (1970-71); Director, Iowa Section (1969-date)

CHARLES S. OULMAN
Associate Professor
Department of Civil Engineering
1957

BS	Iowa State University	Civil Engineering	1955
PhD	Iowa State University	Sanitary Engineering	1963

Physical-chemical water and wastewater treatment processes

100% (50% teaching, 50% research)

"Polyelectrolyte Coatings for Filter Media," Filtration and Separation, 7, 6, p. 682-690, November/December 1970 (with E. R. Baumann)

"Particulate Removal on Coated Filter Media," Journal American Water Works Association, 62, 121, February 1970 (with D. E. Burns and E. R. Baumann)

"Sand and Diatomite Filtration Practices," in Advances in Water Quality Improvement--Physical and Chemical Processes (E. F. Gloyna, ed.), 3, University of Texas, 1969 (with E. R. Baumann)

"Design Requirements of Municipal Diatomite Filters," National Institute of Health and US Environmental Protection Agency, 1964-70, co-investigator

"Removal of Organics by Ultrafiltration," industry-sponsored, 1971-72, principal investigator

"Advanced Wastewater Treatment Using Activated Carbon," Engineering Research Institute, 1972-date

Registered professional engineer: Iowa

Consultant on Waste Treatment in Kenya, United Nations-World Health Organization (March-September 1972)

JAMES C. YOUNG
Associate Professor
Department of Civil Engineering
1968

BS	New Mexico State University	Civil Engineering	1963
MS	New Mexico State University	Sanitary Engineering	1964
PhD	Stanford University	Sanitary Engineering	1968

Biological waste treatment

100% (50% research, 50% teaching)

"Chemical Methods for Nitrification Control," Proceedings, 24th Industrial Waste Conference, Purdue University, May 1969

"Experience with the Oxygen Demand Index (ODI) Test," accepted for publication in Journal Water Pollution Control Federation, 1972 (with L. Shriver)

"The Anaerobic Filter for Waste Treatment," Journal Water Pollution Control Federation, 41, 5, p. 160, May 1969 (with P. L. McCarty)

"An Improved Apparatus for Biochemical Oxygen Demand," Analytical Chemistry, 37, 5, p. 784, May 1965 (with W. Garner and J. W. Clark)

"Packed Beds for Nitrification," General Filter Company, 1972-73, principal investigator

"Electrolytic BOD Determinations," US Environmental Protection Agency, 1970-72, principal investigator

"Design Requirements for Nitrogen Removal," City of Ames, 1972-date, principal investigator

Registered professional engineer: Iowa

Member, Iowa Engineering Society; President, Anson Marston Chapter (1971)

T. AL AUSTIN
Assistant Professor
Department of Civil Engineering
1972

BS	Texas Tech University	Civil Engineering	1967
MS	Utah State University	Civil Engineering	1970
PhD	Texas Tech University	Civil Engineering	1971

Systems analysis, water resources planning and management, environmental impact analysis

100% (50% teaching, 50% research)

"Water Quality Prediction within an Interbasin Transfer System," Water Resources Bulletin, American Water Resources Association, 8, 3, p. 483-494, June 1972 (with W. A. White and L. F. Tischler)

"Alternative Approaches to Water Resource System Simulation," Proceedings, International Symposium on Mathematical Modeling Techniques in Water Resource Systems, Ottawa, Ontario, Canada, May 1972

Previous full-time professional experience: 2 1/2 yrs. (1 1/2 yrs. research and 1 yr. government)

Member, Water Pollution Control Federation
Associate member, American Society of Civil Engineers

DAVID M. MILLARD
Instructor
Department of Civil Engineering
1964

BS	Iowa State University	Electrical Engineering	1962
ME	Iowa State University	Sanitary Engineering	1971

Training of plant operators, application of electrical engineering in pollution control plant design

50% (teaching)

HARRIS F. SEIDEL
Visiting Professor
Department of Civil Engineering
1965

BS	Iowa State University	Civil Engineering	1944
MS	University of Minnesota	Sanitary Engineering	1947
PhD	Iowa State University	Sanitary Engineering	1959

Water and waste treatment plant operation, economic and technical feasibility analysis and evaluation

5% (service on thesis committees, teaching)

"Temperature Effects on Trickling Filters," Sewage and Industrial Waste, 24, 6, p. 705-722, June 1952 (et al.)

"Effect of Preaeration on Primary Treatment of Sewage," Journal Water Pollution Control Federation, 33, 4, p. 339-355, April 1961 (with E. R. Baumann)

"The Operator--Today's Unforgotten Man," Journal Water Pollution Control Federation, 36, 9, p. 1063-1068, September 1964

"How to Get a Mandatory Certification Bill through Your Legislature in Six Very Difficult Lessons," Journal Water Pollution Control Federation, 37, 12, p. 1727-1740, December 1965 (with D. P. Morrow)

"A Statistical Analysis of Water Works Data for 1960," Journal American Water Works Association, 58, 12, p. 1507-1527, December 1966 (with J. L. Cleasby)

Registered professional engineer: Iowa and Minnesota

Previous full-time professional experience: 29 yrs. (6 yrs. consulting and 23 yrs. government)

Consultant (short-term assignments, 1960-date), Agency for International Development, World Bank, and Inter-American Development Bank, in Taiwan, Thailand, Philippines, Honduras, Peru, Nigeria, Uganda, and other countries
Member, Water Pollution Control Federation; President (1963-64)

HOWARD P. JOHNSON
Professor
Agricultural Engineering

PhD	Iowa State University	Agricultural Engineering	1959

Soil and water conservation, erosion-sediment transport
25%

T. E. HAZEN
Professor
Agricultural Engineering
PhD Iowa State University Agricultural Engineering 1956
Animal waste management
25%

ROGER W. BACHMANN
Professor
Fisheries Biology
College of Science and Humanities
PhD University of Michigan Limnology 1962
Limnology
100%

JOHN D. DODD
Professor
Botany
College of Science and Humanities
PhD Columbia University Botany 1947
Freshwater algae
50%

HOMER W. WALKER
Professor
Food Technology
College of Agriculture
PhD University of Wisconsin Microbiology 1955
Water microbiology
20%

JOHN F. TIMMONS
Charles F. Curtiss Distinguished Professor of Agriculture
Agricultural Economics
College of Agriculture
PhD University of Wisconsin Agricultural Economics 1945
Water resources economics
75%

Students

		68-69		69-70		70-71		71-72		72-73	
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT
Sanitary Engineering	Master's	19	2	20	2	17	1	19	1	20	0
	Doctoral	7	0	7	1	6	0	9	0	6	2
Water Resources	Master's	0	0	0	0	3	0	2	1	2	1
	Doctoral	0	0	0	0	0	0	0	0	1	0

ENROLLMENT

		68-69	69-70	70-71	71-72	72-73
Sanitary Engineering	Master's	7	9	6	6	16
	Doctoral	1	3	0	2	2
Water Resources	Master's	0	0	1	2	2
	Doctoral	0	0	0	0	0

GRADUATES

Sanitary Engineering	Master's	0
	Doctoral	2
Water Resources	Master's	0
	Doctoral	0

NON-US NATIONALS

	Sanitary Engr.		Water Resources	
	Master's	Doctoral	Master's	Doctoral
EPA traineeships	14	0	0	0
EPA research fellowship	0	1	0	0
Research graduate assistantship	0	5	2	1
ISU staff--teaching	1	0	0	0
Employer	5	2	1	0
Consulting	38	23	0	-
Industry	5	31	33	-
Federal government	13	0	33	-
Other government	20	8	33	-
Academic	5	31	0	-
Further study	18	0	0	-
Military	1	7	0	-

SUPPORT

Facilities

The Civil Engineering Department has recently (1971) occupied the new G. R. Town Engineering Building. Space occupied by the sanitary engineering section includes 8,985 sq ft divided into faculty and student offices and teaching and research laboratories. Special facilities available for special teaching and research include both the University (iron-removal) and City of Ames (lime-soda softening) water treatment plants, the City water pollution control plant, an agricultural facility for confinement hog and cattle waste handling and treatment (oxidation ditch, anaerobic-aerobic lagoons, and roto-disc systems), and the facilities of the Ames Laboratory of the Atomic Energy Laboratory, including a five megawatt research reactor.

The Johns Hopkins University

Baltimore, Maryland

Department of Geography and Environmental Engineering
College of Arts and Sciences

Engineering Science

ECPD Accredited--Engineering Science

Dr. M. Gordon Wolman, Chairman
Geography and Environmental Engineering
The Johns Hopkins University
Baltimore, MD 21218
(301) 366-3300 x318

February 1974

The Department of Geography and Environmental Engineering deals with the environment and man's impact on it. Its objectives are: (1) to study the operation and interrelationships of the environment--that is, the natural processes of land, air and water; (2) to study man-environment in terms of cultural institutions and social preferences, and to study the impacts on the environment of technological and economic activities; and (3) to utilize such knowledge in developing solutions that can be translated into engineering designs and administrative actions that are acceptable in a democratic society.

These objectives are sought by encouraging each student to tailor-make his graduate program to suit his particular background and future interests. There is no single prescribed set of courses, but breadth must be accompanied by depth of education in a specific science or profession. The department welcomes applicants with backgrounds in the liberal arts, sciences, or engineering. Engineering students develop programs in the areas of water resources, environmental systems, sanitary engineering, or environmental health. Students are encouraged to work in related academic disciplines and in allied programs in environmental studies at the School of Hygiene and Public Health.

The University is located in Baltimore, Maryland, a metropolitan area of 1.5 million people. Total enrollment in the Faculty of Arts and Sciences at the University is approximately 3,000 students--1,000 graduates and 2,000 undergraduate. Annual tuition is $3,000.

Admission Requirements

(a) 3.0/4 GPA required.

(b) GRE is desirable.

(c) GPA can be waived in certain circumstances.

(e) Students with undergraduate disciplines in engineering and natural and social sciences are accepted.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	[a]	Optional	Optional	12 mos.	12-18
PhD[c]	[b]	Yes	1-2[d]	12 mos.	36-48

[a] 1+year equivalent.

[b] 2+year equivalent.

[c] At least one-third of course work is taken outside department. Departmental general exams are followed by the Graduate Board comprehensive orals. The dissertation must be approved by reviewers and defended before a faculty panel.

[d] There are several language options but a good reading knowledge of one language is the minimum accepted.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
EnvEng 301	Water & Wastewater	Brady	3	F'72	17
EnvEng 302	Water & Waste Treatment	Ferguson	3	S'72	15
EnvEng 303	Ecology of Surface Waters	Jensen	3	F'72	25
EnvEng 305	Biological Chemistry Lab.	Ferguson	4	F'72	9
EnvEng 306	Biology of Polluted Waters	Jensen	3	S'72	17
EnvEng 323	Geomorphology	Wolman	4	F'72	20
EnvEng 329	Chem. Phys. Water Pollution	Gavis	3	F'72	15
EnvEng 330	Chem. Phys. Air Pollution	Gavis	3	S'73	16
EnvEng 335	Introduction to Soils Sciences	Cady	3	F'72	3
EnvEng 338	Soil Formation & Morphology	Cady	3	S'73	6
EnvEng 348	Urban & Environmental Management	ReVelle	3	S'73	21
EnvEng 351	Introduction to Hydraulics	Brush	3	F'72	9
EnvEng 352	Open-Channel Hyd./Sed. Trans.	Brush	3	S'73	9
EnvEng 353	Principles of Hydrology	Brush	3	S'72	17
EnvEng 358	Resource Mgt. & Conservation	Hanke	3	S'73	13
EnvEng 603	Water Resource Systems Engineering	ReVelle, Cohon	3	F'71	12
EnvEng 604	Water Resource Systems Engineering	Revelle, Cohon	3	S'72	25
EnvEng 617	Chemical Aqueous Solutions	Ferguson	4	S'73	22
EnvEng 618	Chemical Aqueous Solutions	Gavis	4	New'73	-
EnvEng 665	Water Science Management Seminar	Wolman	2	F'72	14
EnvEng 666	Water Science Management Seminar	Scheidt	2	S'73	11
OpRes 361	Introduction to Mathematical Programming	Elzinga ReVelle	3	F'72	25

OpRes 362	Introduction to Mathematical Programming	Elzinga	3	S'73	20
EnvHea M01	The Environment	Kruse	2	1Q'72	123
EnvHea M01	The Environment (cont'd)	Kruse	2	2Q'72	123
EnvHea A02	Vector Control	Kruse	2	4Q'73	13
EnvHea A03	Municipal Sanitation	Kruse	2	3Q'73	11
EnvHea A04	Environmental Microbiology	Olivieri	2	4Q'72	5
EnvHea A05	Air Pollution Control & Strategy	Kruse	3	1Q'72	14
EnvHea A06	Air Pollution Lab.	Swift	3	2Q'72	8
EnvHea A08	Airborne Particles	Swift	3	3Q'73	6
EnvMed A03	Occupational Health	Baetjer	4	4Q'73	15
RadSci A02	Physics & Dosimetry	Bates	2	3Q'72	-

Faculty

M. GORDON WOLMAN
Professor and Chairman
Department of Geography and Environmental Engineering
1958

BA	Johns Hopkins University	-	1949
MA	Harvard University	Geology	1951
PhD	Harvard University	Geology	1953

Geomorphology, hydrology, water quality, urban services

100% (50% teaching, 30% research, 20% administration)

"The Nation's Rivers," Science, 174, 4012, pp. 905-918, November 1971

"Evaluating Alternative Techniques of Flood Plain Mapping," Water Resources Research, 7, 6, pp. 1383-1392, December 1971

"The Physical Environment and Urban Planning," Geographical Perspectives and Urban Problems, National Academy of Sciences Committee on Geography Symposium, September 20-21, 1971, Washington, pp. 55-70, 1973

"Use of the Chesapeake Bay for Cooling Thermal-Electric Power Plants," Atomic Energy Commission, 11/71-11/72, principal investigator

"Study of the Sources, Movement and Distribution of Sediment in a Small Watershed," US Geological Survey, 6/64-date, principal investigator

"An Evaluation of the Model Cities Sanitation Program of the City of Baltimore," Baltimore Urban Observatory, 9/69-6/72, principal investigator

Previous full-time professional experience: 5 yrs. (government)

Member, American Geophysical Union; President, Section of Hydrology (1970-72)
Chairman, Advisory Committee, Water Quality Standards, State of Maryland (1970-72)
Member, Executive Committee, Earth Sciences Division, National Academy of Sciences (1972-date)

LUCIEN M. BRUSH, JR.
Professor
Department of Geography and Environmental Engineering
1969

BSE	Princeton University	Geological Engineering	1952
PhD	Harvard University	Geology (Geomorphology)	1956

Hydraulics and hydrology, open channel flow, sediment transportation, water pollution, density stratified flow

100% (50% teaching, 40% research, 10% administration)

"Artificial Mixing of Stratified Fluids Formed by Salt and Heat in a Laboratory Flume," New Jersey Water Resources Institute, Rutgers, p. 37, 1970

"Jamaica Bay and Kennedy Airport: A Multidisciplinary Study," National Academy of Science, 1 & 2, p. 178, 1971 (et al.)

"Transport of Pollen in a Sediment Laden Channel: A Laboratory Study," American Journal of Science, 272, pp. 359-38?, 1972 (with G. S. Brush)

"Turbulent Entrainment of Sediment Suspensions across Density Discontinuities," National Science Foundation, 11/70-11/73, principal investigator

"Research on Additions to the Bay," National Science Foundation (RANN), 6/71-10/74, principal investigator--co-team leader

Previous full-time professional experience: 13 yrs. (2 yrs. government and 11 yrs. academic)

Member, American Society of Civil Engineers; Chairman, Sedimentation Committee (1967), Member (1964-66)
Associate Editor, Journal of Geophysical Research (1965-68)
Delegate, University Council Water Resources--Princeton (1963-69), Hopkins (1970-date)
Member, Jamaica Bay Environmental Study Group, National Academy of Sciences-National Academy of Engineering (1971)
Member, Steering Committee, State of Maryland Power Plants Human Health and Welfare Studies Group (1972-date)

JARED L. COHON
Assistant Professor
Department of Geography and Environmental Engineering
1973

BS	University of Pennsylvania	Civil Engineering	1969
SM	Massachusetts Institute of Technology	Civil Engineering	1972
PhD	Massachusetts Institute of Technology	Civil Engineering	1973

Water resources systems, public decision making problems

100% (50% teaching, 50% research)

"Multiobjective Analysis in Water Resource Planning," Water Resources Research, 9, 4, 1973 (with D. H. Marks)

"An Application of Linear Programming to the Preliminary Analysis of River Basin Planning Alternatives," Studies in Linear Programming (H. M. Salkin and J. Saha, eds.), forthcoming (with D. H. Marks)

JOHN F. FERGUSON
Assistant Professor
Department of Geography and Environmental Engineering
1970

BS	Stanford University	Civil Engineering	1963
MS	Stanford University	Civil Engineering	1964
PhD	Stanford University	Civil (Sanitary) Engineering	1970

Wastewater treatment processes (nutrient removal processes), water chemistry (nutrient and trace element cycling)

100% (50% teaching, 50% research)

"Effects of Carbonate and Magnesium on Calcium Phosphate Precipitation," Environmental Science and Technology, 5, pp. 534-540, 1971 (with P. L. McCarty)

"Review of the Arsenic Cycle in Natural Waters," Water Research, 6, pp. 1259-1274, 1972 (with J. Gavis)

Water Chemistry Laboratory Manual, Association of Environmental Engineering Professors, 1972 (et al.)

"Fate of Nutrients in Back River," National Science Foundation (RANN), 6/72-10/74, principal investigator

"Diffusion Limitation on Phytoplankton Growth," National Science Foundation, 2/73-2/74, co-investigator

"Interstitial Water Chemistry of Chesapeake Bay Sediments," National Science Foundation (RANN), 5/73-date, co-investigator

Previous full-time professional experience: 3 yrs. (2 yrs. government and 1 yr. academic)

Member, AEEP
Co-author, AEEP Water Chemistry Laboratory Manual Project (1971-date)
Consultant, Maryland Department of Natural Resources (1972)
Consultant, US Navy Naval Ship Research and Development Center at Annapolis (1972-date)
Consultant, Howard County Department of Public Works (1971-72)

JEROME GAVIS
Associate Professor
Department of Geography and Environmental Engineering
1956

BChE	Polytechnic Institute-Brooklyn	Chemical Engineering	1949
PhD	Cornell University	Chemistry	1953

Chemistry in aqueous systems, atmospheric chemistry, diffusion and dispersion of substances, quantitative ecology

100% (50% teaching, 50% research)

"The Cycling of Mercury through the Environment," Water Research, 6, p. 989, 1972 (with J. F. Ferguson)

"A Review of the Arsenic Cycle in Natural Water," Water Research, 6, p. 1259, 1972 (with J. F. Ferguson)

"Oxidation of Sulfur Dioxide in Stack Plumes," State of Maryland Department of Natural Resources, 2/73-1/75, principal investigator

"Diffusion Limited Growth of Phytoplankton," National Science Foundation, 1/73-12/74, principal investigator

Previous full-time professional experience: 3 yrs. (1 yr. industry and 2 yrs. military)

Member, American Chemical Society (1956-date)
Member, American Institute of Chemical Engineers (1960-date)
Member, American Association for the Advancement of Science (1965-date)
Exchange Scientists, US--USSR Academy of Sciences Exchange Program at the Institute of Electrochemistry, Moscow, USSR (May-October 1965)

STEVE H. HANKE
Associate Professor
Department of Geography and Environmental Engineering
1969

BS	University of Colorado	Business Administration	1964
PhD	University of Colorado	Economics	1969

Economic and legal aspects of wetlands management, economics of public works and water resources planning, resource economics, resource management and conservation, public utility economics

100% (40% teaching, 60% research)

"Demand Management through Responsive Pricing," Journal American Water Works Association, 63, 9, 1971 (with R. K. Davis)

"Municipal Water," in Benefit-Cost Analysis 1971 (A. Harberger, et al., eds.), Aldine-Atherton. Inc., Chicago, 1972 (with R. K. Davis)

"The Demand for Water under Dynamic Conditions," Water Resources Research, 6, 5, 1970

"Pricing Urban Water," in Public Prices for Public Products (Selma Mushkin, ed.), The Urban Institute, Washington, DC, 1972

"Water Requirements or Water Demands?" Journal American Water Works Association, 63, 11, 1971 (with J. J. Boland)

"The Economics of Common Property Resources," National Audubon Society, 1/73-date, principal investigator

"The Economics of Kenya's Game Skins Industry," jointly sponsored by National Audubon Society, Welder Wildlife Foundation and World Wildlife Fund, 7/72-8/72, principal investigator

"An Economic and Legal Assessment of Wetlands Management," National Science Foundation, 1/72-5/73, co-principal investigator

Previous full-time professional experience: 6 yrs. (academic)

Co-chairman, Study Team on Economic Implications of Environmental Quality and Materials Policy, National Academy of Sciences-National Academy of Engineering (1972-date)
Member, Committee on the Study of Environmental Problems Affecting a National Materials Policy, National Academy of Sciences-National Academy of Engineering (1972-date)
Research Associate, National Museums of Kenya, Nairobi, Kenya (July-August 1972)
Executive Board Member, Universities Council on Water Resources (1972-date)

LOREN D. JENSEN
Associate Professor
Department of Geography and Environmental Engineering
1965

BS	University of Utah	Biological Sciences	1960
MS	University of Utah	Biology	1962
PhD	University of Utah	Limnology	1965

Aquatic biology, pollution ecology

100% (50% teaching, 50% research)

"Spectrum of Biological Concerns from Power Plant Thermal Discharges," Electric Power and Thermal Discharges (M. Eisenbud and G. Gleason, eds.), Gordon and Breach, New York, pp. 47-73, 1970

"The Effects of Elevated Temperatures upon Aquatic Invertebrates," Report No. 4, Cooling Water Studies for Edison Electric Institute, Edison Electric Institute Publication No. 69-900, 1969 (et al.)

"Long-term Effects of Organic Insecticides on Two Species of Stonefly Naiads," Transactions of the American Fisheries Society, 93, 4, pp. 357-363, 1964 (with A. R. Gaufin)

"Effects of Ten Organic Insecticides on Two Species of Stonefly Naiads," Transactions of the American Fisheries Society, 93, 1, pp. 27-34, 1964 (with A. R. Gaufin)

"Aquatic Ecosystems and Thermal Power Plants," Journal of the Power Division, American Society of Civil Engineers, 97, pp. 209-217, 1971 (with D. K. Brady)

"Biological Effects of Thermal Effluents Associated with Thermal Electric Power Generating Utilities," Edison Electric Institute," 7/66-date, principal investigator

"Presiting Environmental Research--Chesapeake Bay System," Power Plant Siting Program, Maryland Department of Natural Resources, 7/71-date, principal investigator

"Removal of Nutrients from Closed Water Systems," US Department of Interior, National Aquarium and Fisheries Center, 7/68-6/72, principal investigator

Member, American Society of Limnology and Oceanography (1960-date)
Member, Ecological Society of America (1962-date)
Chairman, Environmental and Natural Resources Committee, Task Force for Nuclear Power Policy, Southern Governors Conference (1969-70)
Member, Ad Hoc Water Research Coordinating Committee, Office of the Secretary, US Department of the Interior (1970-date)
Chairman, Subcommittee on Entrainment Standards, American Nuclear Society Standards Committee 18.3, Non-Radioactive Standards for Nuclear Power Plants (1972-date)

CORNELIUS W. KRUSE
Professor and Chairman
Department of Environmental Health
School of Hygiene and Public Health
1947

BS	Missouri School of Mines	Civil Engineering	1934
MS	Harvard University	Sanitary Engineering	1940
DPH	University of Pittsburgh	Public Health	1961

Municipal sanitation, environmental health, vector control, sanitary and industrial health engineering

100% (50% teaching, 25% research, 25% administration)

"The Enhancement of Viral Inactivation by Halogens," Water and Sewage Works, 118, 6, 1971 (with V. P. Olivieri and K. Kawata)

"Halogen Action on Bacteria, Viruses and Protozoa," Proceedings, National Specialty Conference on Disinfection, University of Massachusetts, Amherst, 1970 (et al.)

"Our Nation's Water: Its Pollution Control and Management," Advances in Environmental Sciences, 1, (Pitts and Metcalf, eds.), John Wiley and Sons, 1961

"Study and Management of the Atmospheric Environment," US Environmental Protection Agency, 9/72-8/75, principal investigator

"Improvement in Terminal Disinfection of Sewage Effluent," US Army Medical Research and Development Command, 10/71-9/73, principal investigator

Registered professional engineer: Missouri and Maryland

Previous full-time professional experience: 11 yrs.

Diplomate, AAEE
Associate Member, Expert Committee on Insecticides, World Health Organization, Geneva, Switzerland (1959)
Member, Advisory Council on Comprehensive Health Planning, State of Maryland (1969-71)
Chairman, Panel on Recreation as Aesthetics, Water Quality Criteria Revision Project, Environmental Studies Board, National Academy of Sciences (1972-date)

CHARLES REVELLE
Associate Professor
Department of Geography and Environmental Engineering
1968

BChE	Cornell University	Chemical Engineering	1961
PhD	Cornell University	Civil Engineering	1967

Urban and environmental management, water resources systems engineering

100% (50% teaching, 50% research)

Sourcebook of the Environment, Scientific Dimensions, Houghton Mifflin Company, 1974 (with Penelope ReVelle)

"Linear Programming Applied to Water Quality Management," Water Resources Research, February 1968 (with D. Loucks and W. Lynn)

"Linear Decision Rule in Reservoir Management and Design," Parts 1, 2, and 3, Water Resources Research, August, 1969, August 1970, January 1973 (et al.)

Previous full-time professional experience: 7 yrs. (academic)

Member, Operations Research Society of America (1965-date)
Member, Institute of Management Sciences (1966-date)
Member, Regional Science Association (1970-date)

DONALD W. PRITCHARD
Professor and Director, Chesapeake Bay Institute
Professor, Department of Earth and Planetary Sciences

PhD	Scripps Institution	Oceanography	1951

Kinematic and dynamics of estuarine and coastal circulation
75%

Students

	69-70		70-71		71-72		72-73		73-74		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master's	3	2	3	3	5	3	8	6	6	2	ENROLLMENT
Doctoral	16	5	18	5	21	10	22	17	17	10	
Master's	2		2		0		7		6		GRADUATES
Doctoral	4		2		7		10		6		
Master's	1										NON-US NATIONALS
Doctoral	2										

	Master's	Doctoral	
EPA traineeship	1	5	SUPPORT
Other traineeship	1	1	
Research assistantship	4	8	
Teaching assistantship	0	1	
Other university support	0	3	
Government employer	0	1	
Self-supported	8	20	
Consulting	2	2	EMPLOYMENT (%)
R & D	3	2	
Industry	5	3	
Federal government	20	12	
Other government	15	20	
Academic	20	55	
Further study	35	6	

Facilities

Fully-equipped water chemistry and biology laboratories plus open space labs for setting up pilot and other research facilities are among the facilities available. Graduate students have individual research laboratories as needed. The department has boats and vehicles for field studies and liberal assortment of field equipment. Office equipment includes various types of reproduction systems. Computer consoles are available to students and staff for use in office or classroom. Shop and other services are also available. Computer center and library facilities are excellent.

The University of Kansas

Lawrence, Kansas

Civil Engineering Department
School of Engineering

Environmental Health Engineering
Environmental Health Science

ESTABLISHED 1865

Dr. Walter J. O'Brien
Department of Civil Engineering
Room 208 Learned Hall
The University of Kansas
Lawrence, KS 66044
(913) 864-3731

May 1973

The primary orientation of the environmental health program at the University of Kansas are the technical and social aspects of water pollution control, water quality management, and solid wastes management. The MS and PhD degrees are offered in environmental health engineering and environmental health science.

The University has two campuses: The School of Medicine located in Kansas City and eleven other schools located in Lawrence. The total undergraduate enrollment is approximately 17,500 with about 13,500 of these undergraduates attending classes in Lawrence. The undergraduate enrollment in the School of Engineering is 850. The University places great emphasis on graduate education and has a total graduate school enrollment of approximately 3,760 full-time students. Two hundred and twenty of these individuals are enrolled in the School of Engineering.

Lawrence is a community of approximately 45,000 persons located in the rolling hills of eastern Kansas approximately 25 miles west of the Kansas City metropolitan area. The university campus is situated atop Mount Oread, a limestone bluff, overlooking the Kansas and the Wakarusa River valleys. A wide variety of cultural and sports activities are available on campus and in Kansas City.

Admission Requirements

(a) 3.0/4 for MS and 3.4/4 on Master's work for PhD.

(b) GRE is not required unless individual intends to apply for scholarship aid.

(c) Admission to Master's program is possible for GPA down to 2.7/4 provided strong recommendations are submitted. Student must obtain 3.0/4 in first semester to obtain full graduate standing.

(d) Foreign students must score a minimum of 525 on the TOEFL examination.

(e) Graduation from an ECPD accredited engineering program (any discipline) is required for entry into the engineering graduate program. Individuals entering the science program are evaluated on an individual basis--undergraduate degrees in chemistry, biology, physics, or mathematics are preferred.

(f) Program requirements for nonengineers depend primarily upon the prior curriculum and the career objectives of the individual.

(g) Prior to acceptance foreign students must provide evidence of sufficient financial resources to cover round-trip transportation from the country of origin and living expenses within the United States for one full year.

(h) Applicants must have three letters of recommendation. At least two of these letters must be from former professors who have had extensive contact with the individual.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Health Engr.	[a]	Optional	No	1S	12
MS--Envir. Health Science	[a]	Optional	No	1S	12
PhD--Envir. Health Engr.	72S[b]	Yes	Optional	2S	36
PhD--Envir. Health Science	72S[b]	Yes	Optional	2S	36

[a] Thesis option requires total of 30 credit hours including 6-10 hours of thesis. Nonthesis option requires 33 credit hours including 3 hours of special problems. Full-time students on campus are strongly urged to undertake a thesis.

[b] PhD program requires a minimum of 48 credit hours of formal course work plus two research skills, which can include foreign languages and can be satisfied by either completion of a designated sequence of courses or by examination. The type and the method used for satisfying research skills are determined on an individual basis.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 170	Sanitary Chemistry I	McKinney	2S	F'72	38
CE 171	Sanitary Chemistry Lab.	McKinney	1S	F'72	13
CE 173	Applied Microbiology	McKinney	4S	F'72	17
CE 176	Water Supply & Sewage	O'Brien	4S	S'72	14
CE 177	Marine Pollution	Angino	3S	S'72	19

CE 272	Sanitary Engineering Design	Burkhead	3S	S'73	4
CE 273	Sanitary Chemistry II	Angino	2S	S'73	3
CE 275	Environmental Health Administration	McKinney	3S	F'70	40
CE 276	Air Pollution	O'Brien	3S	S'73	12
CE 277	Water Quality	O'Brien	3S	F'72	18
CE 348	Physical & Chemical Treatment I	Burkhead	4S	F'72	5
CE 349	Physical & Chemical Treatment II	Burkhead	4S	S'73	7
CE 370	Radioactive Waste Disposal	Burkhead	2S	Su'69	12
CE 375	Solid Waste Disposal	McKinney	2S	S'73	16
CE 376	Biological Waste Treatment	McKinney	3S	S'73	32
CE 377	Industrial Water & Wastes	Burkhead	3S	F'72	32
CE 378	Environmental Health Literature	Burkhead	1S	F'72	10
CE 379	Environmental Health Seminar	Staff	1S	Irregular	-
CE 390	Thesis	Staff	6-10S	S'73	6
CE 391	Research	Staff	1-10S	S'73	4
CE 392	Advanced Topics	McKinney	2S	Su'72	12
CE 396	PhD Thesis	Staff	1-15S	S'73	2

No specific courses are required for either the environmental health engineering or science degrees. A course of study is developed for each individual upon initial enrollment.

Faculty

ROSS E. McKINNEY
Parker Professor of Civil Engineering
1960

BA	Southern Methodist University	Mathematics & Chemistry	1948
BS	Southern Methodist University	Civil Engineering	1948
SM	Massachusetts Institute of Technology	Sanitary Engineering	1949
ScD	Massachusetts Institute of Technology	Sanitary Engineering	1951

Biological wastewater treatment systems, solid waste management

100% (50% teaching, 50% research)

"An Economic Evaluation of Garbage Grinding vs. Surface Collection," Water and Sewage Works, Ref. No. R 54-56, 1971 (with J. L. Mahloch)

"Ahead: Activated Algae?" Water and Wastes Engineering, 8, 9, pp. 51-64, 1971 (et al.)

"Design and Operation of a Biotreatment System for a Small Industry," Proceedings, 23rd Annual Sanitary Engineering Conference, University of Kansas, 1973

Registered professional engineer: Kansas and Massachusetts

Previous full-time professional experience: 2 yrs. (industry)

Diplomate, AAEE
Member, American Society of Civil Engineers; Chairman and member of Education Committee (1963-66)
Consultant, US Environmental Protection Agency, National Science Foundation, and National Research Council (1960-date)
Member, Kansas Water Quality Advisory Council (1965-date)
Member, Kansas Solid Waste Advisory Council (1970-date)

ERNEST E. ANGINO
Professor and Chairman, Department of Geology
Professor of Civil Engineering
1965

BS	Lehigh University	Mining Engineering	1954
MS	University of Kansas	Geology	1958
PhD	University of Kansas	Geochemistry	1961

Water chemistry

25% (20% teaching, 5% research)

"Identification of Manganese in Water Solutions by Electron Spin Resonance," Nonequilibrium Systems in Natural Water Chemistry, Advances in Chemistry Series No. 106, American Chemical Society, 1971 (with L. R. Hathaway and T. Worman)

"Fe, Mn, Ni, Co, Sr, Li, Zn, and SiO_2 in Streams of the Lower Kansas River Basin," Water Resources Research, 5, pp. 698-705, 1969 (with O. K. Galle and T. C. Waugh)

"Arsenic in Detergents: Possible Danger and Pollution Hazard," Science, 168, pp. 389-390, 1970 (et al.)

Previous full-time professional experience: 3 yrs. (industry)

Chairman, American Society for Testing and Materials Committee D-19.9 on Saline Water Standards
Member, US National Committee on Geochemistry (National Academy of Science)

CARL E. BURKHEAD
Associate Professor of Civil Engineering
1969

BS	University of Missouri-Rolla	Chemical Engineering	1957
MS	University of Kansas	Environmental Health Engineering	1964
PhD	University of Kansas	Environmental Health Engineering	1966

Biological wastewater treatment systems, physical and chemical wastewater treatment

100% (50% teaching, 50% research)

"Application of Complete-Mixing Activated Sludge Design Equations to Industrial Wastes," Journal Water Pollution Control Federation, 40, pp. 557-570, 1968 (with R. E. McKinney)

"Analog Simulation of Activated Sludge Systems," Journal Sanitary Engineering Division, American Society of Civil Engineers, 95, SA3, pp. 593-606, 1969 (with D. J. Wood)

"Biological Treatment of a Distillery Waste," Proceedings, 23rd Industrial Waste Conference, Purdue University, Part 1, pp. 520-527, 1968 (with C. A. Lessig and T. R. Richardson)

"The Tertiary Treatment of Confined Hog Farm Wastewaters," Kansas Water Resources Research Institute, 6/71-12/72, principal investigator

"A Fixed Media Complete Mixing Activated Sludge System," Smith and Loveless Division of Ecodyne Corporation, 5/71-8/72, principal investigator

Registered professional engineer: Kansas

Previous full-time professional experience: 5 yrs. (2 yrs. industry and 3 yrs. research)

Member, AEEP
Member, Water Pollution Control Federation; Member, Research Committee (1972-date)
Member, Manpower Needs Committee, Association of Environmental Engineering Professors (1971-date)
Member, Sanitary Engineering Technology, Ad Hoc Visiting Committee, Engineers' Council on Professional Development

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WALTER J. O'BRIEN
Associate Professor of Civil Engineering
1965

BS	New Mexico State University	Civil Engineering	1957
MS	New Mexico State University	Civil Engineering	1962
ScD	New Mexico State University	Civil Engineering	1965

Water quality management, physical and chemical wastewater treatment

100% (50% teaching, 50% research)

"A Continuous Flow Automatically Recording Respirometer," Biotechnology and Bioengineering, 8, pp. 721-739, 1971 (with R. W. Agnew and M. R. Chun)

"Two Methods for Algae Removal from Oxidation Pond Effluents," Water and Sewage Works, 120, pp. 66-73, 1973 (et al.)

"Modeling Discharge and Conservative Water Quality in the Lower Kansas River Basin," Bulletin 204, Part 3, Kansas State Geological Survey, 1972 (et al.)

"Use of Water Softening Sludge in Sewage Treatment," Kansas Water Resources Research Institute, 9/69-12/72, principle investigator

"Oxygen Consumption in Continuous Culture," US Environmental Protection Agency, 1/67-5/71, principal investigator

Previous full-time professional experience: 1 1/2 yrs. (1/2 yr. industry and 1 yr. consulting)

Member, Water Pollution Control Federation; Member, Research Committee (1972-date)
Member, American Society of Civil Engineers; Member, Water Quality Research Council, Sanitary Engineering Division (1966-69)

ROBERT L. SMITH
Ackers Professor of Civil Engineering
MS University of Iowa Civil Engineering 1948
Engineering hydrology, water resources planning
50%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Health Engineering	Master's	2	26	3	37	2	42	4	27	6	23	
	Doctoral	6	2	5	3	1	3	3	4	2	5	ENROLLMENT
Environmental Health Science	Master's	1	0	4	0	4	2	5	4	2	6	
	Doctoral	0	0	1	0	2	0	5	0	4	0	

		68-69	69-70	70-71	71-72	72-73	
Environmental Health Engineering	Master's	4	6	9	11	11	
	Doctoral	3	1	5	1	1	GRADUATES
Environmental Health Science	Master's	1	0	5	4	3	
	Doctoral	0	0	1	2	0	

Environmental Health Engineering	Master's	3	
	Doctoral	2	NON-US NATIONALS
Environmental Health Science	Master's	0	
	Doctoral	1	

	Envir. Health Engr.		Envir. Health Sci.		
	Master's	Doctoral	Master's	Doctoral	
EPA traineeship	3	0	2	2	
Research assistantship	0	2	0	0	
Teaching assistantship	0	0	0	1	
Government employer	8	2	6	1	SUPPORT
Consultant employer	11	1	0	0	
Industry employer	3	2	-	0	
Self supported	4	0	0	0	

	Envir. Health Engr.		Envir. Health Sci.	
	Master's	Doctoral	Master's	Doctoral
Consulting	33	0	0	0
Industry	5	20	17	0
Federal government	30	0	42	0
Other government	27	0	0	0
Further study	5	0	33	0
Academic	0	80	0	100
Outside environmental area	0	0	8	0

EMPLOYMENT
(%)

Kansas State University

Manhattan, Kansas

Department of Civil Engineering
College of Engineering

Civil Engineering

ECPD Accredited--Civil Engineering

Dr. Lawrence A. Schmid, Associate Professor
Department of Civil Engineering
Kansas State University
Manhattan, KS 66506
(913) 532-5862

June 1973

The MS Degree is presently the terminal degree offered in the environmental engineering area. Because of this there is reduced emphasis within the program on theoretical research and increased emphasis placed on preparing the student for professional practice. The program is small, allowing for good student-faculty interaction.

The University is a land-grant institution with heavy emphasis on engineering and applied sciences. The enrollment is about 15,000 of which 2,500 are graduate students. Tuition and fees for full-time graduate students are $526 per academic year.

Manhattan (population 30,000) is situated in the rolling flint hills of northeast Kansas, 125 miles west of Kansas City, via Interstate 70. Located five miles north of the city is Tuttle Creek Reservoir, one of the largest lakes in the Midwest.

Admission Requirements

(a) 3.0/4 or better in the junior and senior years is required for admission.

(b) GRE is not required.

(c) Admission to Master's program is possible for GPR down to 2.3/4 provided strong recommendations are submitted. Student must then obtain a 3.0/4 in first semester in order to obtain full graduate standing.

(d) Foreign students must score a minimum of 600 on TOEFL.

(e) Any engineering discipline at an accredited institution is acceptable.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	[a]	Optional	No	1S	12

[a] Thesis option requires 24S course work and 6S thesis; nonthesis option requires 30S course work and 2S report.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 761	Sanitary Engineering Chemistry	Wallace	3S	F'72	8
CE 762	Water Treatment Systems	Schmid	3S	F'72	6
CE 766	Waste Treatment Systems I	Schmid	3S	S'73	11
CE 767	Waste Treatment Systems II	Wallace	3S	S'73	7
CE 863	Adv. Topics in Sanitary Engineering	Staff	1-3S	S'73	4
Bio 693	Limnology	-	2S	S'73	3
Chem 618	Air and Water Analysis	-	2S	F'73	2

The CE courses listed above are required of all majors.

Faculty

LAWRENCE A. SCHMID
Associate Professor
Department of Civil Engineering
1968

BS	Iowa State University	Civil Engineering	1962

MS	Iowa State University	Civil Engineering	1963
PhD	University of Kansas	Environmental Health Engineering	1968

Biological waste treatment systems, stream pollution, nutrient removal, agricultural waste management

100% (80% teaching, 20% research)

"Phosphate Removal by a Lime-Biological Treatment Scheme," Journal Water Pollution Control Federation, July 1969 (with R. E. McKinney)

"Field Evaluation of Aerators in Activated Sludge Systems," Proceedings, 23rd Purdue Industrial Waste Conference, Lafayette, Indiana, May 1968. Also, Water and Sewage Works, November 1968 (with J. T. Pfeffer and F. C. Hart)

"Land Disposal of Cattle Feedlot Wastes," Proceedings, International Symposium on Livestock Wastes, Columbus, Ohio, April 1971 (with H. L. Manges and L. S. Murphy)

"Pilot Plant Demonstration of a Lime-Biological Treatment Phosphorus Removal Method," US Environmental Protection Agency, 9/69-1/72, principal investigator

"Demonstration and Development of Facilities for the Treatment and Ultimate Disposal of Cattle Feedlot Wastes," US Environmental Protection Agency, 6/69-12/73, co-principal investigator

"Effect of Holding Time on Retention-Pond Effluent," Kansas Water Resources Research Institute, 6/73-6/74, principal investigator

Registered professional engineer: Kansas

Previous full-time professional experience: 3 yrs. (government)

Member, AEEP
Member, American Society of Civil Engineers; Member, Agricultural Waste Management Committee (1972-date)

DOUGLAS A. WALLACE
Assistant Professor
Department of Civil Engineering
1971

BS	University of Illinois	Civil Engineering	1960
MS	University of Iowa	Environmental Engineering	1968
PhD	University of Iowa	Environmental Engineering	1971

Water and wastewater treatment processes, stream pollution, computer simulation of water quality in streams

100% (80% teaching, 20% research)

"Determination of Land Runoff Effects on Dissolved Oxygen by Mathematical Modeling," accepted for publication, Journal Water Pollution Control Federation

Registered professional engineer: Illinois and Iowa

Previous full-time professional experience: 7 yrs. (consulting)

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Envir. Engr.	Master's	0	-	3	-	4	-	3	-	5	-	ENROLLMENT
Envir. Engr.	Master's	0		1		2		2		3		GRADUATES

Envir. Engr. Master's 1 NON-US NATIONALS

	Master's	
Teaching assistantship	1	SUPPORT
Research assistantship	3	
Self-supported	1	
Consulting	70	EMPLOYMENT (%)
Industry	15	
Government	15	

Facilities

The environmental engineering section of the Department of Civil Engineering at Kansas State has over 1200 sq ft of finished laboratory space. The laboratory is equipped for bench scale studies and to perform most of the tests normally used in water and wastewater analyses. In addition, the Department has a 20,000 gpd activated sludge pilot plant which is used to conduct larger scale studies in biological waste treatment.

University of Kentucky

Lexington, Kentucky

Department of Civil Engineering
College of Engineering

Civil Engineering

ECPD Accredited--Civil Engineering

Dr. Robert A. Lauderdale, Professor
Department of Civil Engineering
University of Kentucky
Lexington, KY 40506
(606) 257-1832

May 1973

The program emphasizes the principles and practice of water resources management, including water pollution control, water resources planning, stream quality maintenance, and design. The degrees offered are MSCE and PhD.

The University is the land-grant institution in Kentucky with a Lexington campus enrollment of 20,000 of which approximately 1,100 are enrolled in the College of Engineering. Tuition and fees for full-time graduate students average $530 for two semesters.

The University of Kentucky is located in Lexington, a city with an urban population of approximately 175,000. The area is world renowned as the center of the thoroughbred horse industry and for the scenic beauty of the surrounding horse farms. An abundance of cultural and sporting events provides a highly diversified program for entertainment and relaxation.

Admission Requirements

(a) 2.5/4 minimum undergraduate GPA.

(b) Aptitude tests only of GRE is required and is generally taken during the first semester of graduate program.

(c) Provisional admission is possible with recommendation of the department to the Graduate School.

(d) Minimum score of 500 on TOEFL is required for foreign students.

(e) Undergraduate disciplines acceptable for admission include civil, chemical, mechanical engineering.

(f) Make-up courses required of nonengineers generally include mathematics through differential equations and fluid mechanics.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engr.	[a]	Optional	No	2S	10-12
PhD--Civil Engr.	Varies	Yes	1	24 mos.	36

[a] Thesis option requires 24S plus thesis; nonthesis option requires 30S of course work.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 555	Engineering Economy	Elmore	3S	F'72	40
CE 568	Sanitary Engineering Laboratory	Lauderdale	3S	F'72	10
CE 659	Adv. Sanitary Engineering Design	Lauderdale	3S	S'73	4
CE 662	Water Quality Control I	Lauderdale	3S	F'72	10
CE 663	Water Quality Control Laboratory	Foree	3S	S'73	5
CE 664	Water Quality Control II	Foree	3S	S'73	17
CE 669	Water Quality in Sur. Water	Foree	3S	F'72	18
CE 655	Water Resources Planning	Elmore	3S	S'73	3
ChemEng 580	Rate Processes for Pollution Control	Conger	3S	S'73	-
Zoo 521	Limnology	Kuehne	3S	S'73	-
CE 652	Open Channel Flow	Kao	3S	F'72	10
CE 674	Mech. Flow in Pipes	Wood	-	F'72	15

CE 568, 662, 663, 664, 669 and ChemEng 580 are required for water pollution majors.

Faculty

ROBERT A. LAUDERDALE
Professor
Department of Civil Engineering
1958

BS	University of Tennessee	Chemical Engineering	1944
MS	University of Tennessee	Chemical Engineering	1948
PhD	Massachusetts Institute of Technology	Sanitary Engineering	1958

Aquatic chemistry, physical-chemical processes

100% (60% teaching, 40% research)

"Biodegradation of Malathion," Proceedings, American Society of Civil Engineers, SA6 December 1967 (with C. W. Randall)

"A Study of the Removal of Pesticides from Water," Research Report No. 8, Water Resources Institute, 1967 (with J. D. Whitehouse)

"Persistence of Pesticides in the Environment," Research Report No. 17, Water Resources Institute, 1969

"Use of Lagoons for Tertiary Treatment," Office of Water Resources Research, 7/73-6/75, principal investigator

Registered professional engineer: Kentucky

Previous full-time professional experience: 13 yrs. (3 yrs. industry, 9 yrs. research, and 1 yr. academic)

Consultant, US Environmental Protection Agency (1972-date)
Consultant, State Health Department (1972)
Member, Kentucky Board of Certification for Operators (1967-date)

EDWARD G. FOREE
Assistant Professor
Department of Civil Engineering
1968

BS	University of Kentucky	Civil Engineering	1964
MS	Stanford University	Civil (Envir.) Engineering	1965
PhD	Stanford University	Civil (Envir.) Engineering	1968

Biological and physical-chemical wastewater treatment, surface water quality analysis and control, effects of algae on water quality

100% (50% teaching, 50% research)

"The Extent of Nitrogen and Phosphorus Regeneration from Decomposing Algae," Advances in Water Pollution Research, 5, pp. III-27/1 through III-27/15, Pergamon Press, 1971 (with W. J. Jewell and P. L. McCarty)

"Anaerobic Decomposition of Algae," Environmental Science and Technology, 4, pp. 842-849, 1970 (with P. L. McCarty)

"Carbon and Nitrogen as Regulators of Algal Growth in Sewage Treatment Plant Effluent," Proceedings, 2nd Annual Environmental Engineering and Science Conference, University of Louisville, 1972 (with C. R. Scroggin)

"Aerobic Biological Stabilization of Sanitary Landfill Leachate," Journal Water Pollution Control Federation, accepted for publication in 1973 (with E. N. Cook)

"The Effects of Disposable Diapers Padding Material on Municipal Wastewater Treatment Processes," Proceedings, 3rd Annual Environmental Engineering and Science Conference, University of Louisville, 1973

"Algal Growth and Decomposition Effects on Water Quality," Office of Water Resources Research, 9/68-2/70, principal investigator

"Algal Growth and Decomposition: Effects on Water Quality, Phase II," Office of Water Resources Research, 11/69-6/71, principal investigator

"Effects of the Flushable Portion of Disposable Diapers on the Operation of Municipal Waste Treatment Plants," Procter and Gamble Company, 7/71-12/71, principal investigator

Registered professional engineer: Kentucky

Member, Water Pollution Control Federation; Member, Research Committee (1972-date)
Member, Kentucky-Tennessee Section American Water Works Association; Member, Education Committee (1969-date)
Member, American Society of Civil Engineers; Member, Paper Review Committee, Journal Environmental Engineering Division (1969-date)
Consultant to several industries on wastewater treatment (1969-date)

ROY ELMORE
Assistant Professor
Department of Civil Engineering
1970

BSCE	Drake University	Civil Engineering	1957
MSSE	University of North Carolina	Sanitary Engineering	1958
PhD	Georgia Institute of Technology	Water Resources	1972

Water resources planning, hydrology

100% (50% teaching, 50% research)

"State Organization for Water Resources Management," ERC-0472, Environmental Resources Center, Georgia Institute of Technology, May 1972

"The Peachtree Creek Watershed as a Case History in Urban Flood Plain Development," ERC-0971, Environmental Resources Center, Georgia Institute of Technology, October 1971 (et al.)

"Georgia Laws, Policies and Program Pertaining to Water and Related Land Resources," Water Resources Center, Georgia Institute of Technology, June 1967

"Rainfall-Runoff Relationships for Drainage Design on Small Urban Watersheds," Kentucky Department of Highways, principal investigator

Previous full-time professional experience: 7 yrs. (5 yrs. government and 2 yrs. consulting)

Consultant, City-County Governments on Solid Waste Disposal (1972)

WILLIAM L. CONGER
Associate Professor
Chemical Engineering

PhD	University of Pennsylvania	Chemical Engineering	1965

Design of rate and equilibrium processes for water pollution control
25%

ROBERT A. KUEHNE
Associate Professor
School of Biological Sciences

PhD	University of Michigan	Zoology	1958

Limnology and ecology, effects of pollutants on aquatic environment
50%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Civil Engineering	Master's	19	0	11	0	13	0	18	0	10	0	ENROLLMENT
(Sanitary)	Doctoral	1	0	1	0	1	0	0	0	1	0	

		68-69	69-70	70-71	71-72	72-73	
Civil Engineering	Master's	9	6	7	6	7	GRADUATES
(Sanitary)	Doctoral	[illegible]	0	1	0	0	

Civil Engineering	Master's	1	NON-US NATIONALS
(Sanitary)	Doctoral	0	

	Master's	Doctoral	
EPA traineeship	4	0	SUPPORT
Industrial fellowship	0	1	
Government employer	1	0	
Consultant employer	1	0	

	Master's	Doctoral	
Consulting	30	100	EMPLOYMENT (%)
Federal government	40	0	
Other government	25	0	
Unknown	5	0	

Facilities

The College of Engineering Library is considered to be one of the best in the region and has complete access to all of the available literature in the field. The University Computing Center is located in the building adjacent to the College of Engineering and the IBM 360 Model 65 computer is available to students for training and research. The sanitary engineering laboratories are equipped with the most modern analytical and control equipment for use in teaching and research in all aspects of conventional and advanced waste treatment technology.

University of Maine-Orono

Orono, Maine

Department of Civil Engineering
College of Technology

Sanitary Engineering

Dr. Otis J. Sproul, Professor
Department of Civil Engineering
355 Aubert Hall
University of Maine
Orono, ME 04473
(207) 581-7693

February 1974

The orientation of the sanitary engineering graduate program at the University of Maine is essentially towards water related subjects. Within the sanitary engineering degree program, the student can specialize to some extent in water quality management, aquatic chemistry, water pollution control, industrial wastewater management, water resources management, and public health aspects of wastewater management. MS and PhD degrees are both offered in sanitary engineering.

The University is a land-grant institution with equal emphasis on engineering, applied sciences, and liberal arts and sciences. The University of Maine system has eight campuses within the state. The Orono campus is the largest with a strong emphasis on graduate education and research. The enrollment is around 9,000 with approximately 900 graduate students. Associated with the University is the Land and Water Resources Center, Ira C. Darling Center for Oceanographic Research and Teaching. Tuition and fees for full-time graduate students average $550 per academic year for residents of Maine and $1,650 for the academic year for nonresidents. This program has been designated as the New England Regional Program in Sanitary Engineering by the New England Board of Higher Education.

The Orono campus is located 40 miles off the Atlantic coast and within an hour's drive from the Acadia National Park. Orono is located 250 miles northeast of Boston and all the major ski areas in the state are within two hours' drive from the campus. Wilderness recreation opportunities for fishing, canoeing, camping, etc. are available in the immediate area. The population of the Town of Orono is about 12,000. The nearest urban center is Bangor, 8 miles from Orono, with a population of about 50,000. The entire region is served by the Bangor International Airport.

Admission Requirements

(a) 2.8/4 for MS; 3.3/4 on Master's work or 3.0/4 overall for PhD.

(b) GRE is required: 480 verbal, 650 quantitative, 480 advanced for MS; 500 verbal, 710 quantitative, 500 advanced for PhD.

(c) Conditional acceptance to Master's program is possible with GPA down to 2.4/4 provided strong recommendations are submitted. Students must obtain 3.0/4 in their first semester to obtain full graduate standing.

(d) Foreign students must have a minimum TOEFL score of 550 for admission to the graduate program.

(e) Any engineering graduate from an accredited institution is acceptable. Applicants with backgrounds in physics, biology, zoology, and chemistry are accepted with special approval by the faculty selection committee.

(f) Nonengineering students must present course credit in ordinary differential equations, introductory fluid mechanics, and an introductory sanitary engineering course.

(g) Three letters of recommendation are required of all students applying for admission of which at least one should be from a former professor.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Sanitary Engineering	30S[a]	Yes	No	1S	12
PhD--Sanitary Engineering	No	Yes	1	12 mos.	30

[a] 6S for thesis.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
Ce 155	Hydrology	Brutsaert	3S	F'73	25
Ce 178	Chemistry in Sanitary Engineering	Ghosh, Woodard	3S	F'72	12
Ce 179	Microbiology in Sanitary Engineering	Hall	4S	F'71	12
Ce 230	Water Resources Engineering	Brutsaert	3S	S'73	10
Ce 240	Radiological Health	Staff	3S	S'67	8
Ce 320	Physicochemical Processes for Water Pollution Control	Ghosh	3S	F'72	10
Ce 322	Biological Proc. for WW Treatment	Ghosh	3S	S'73	8
Ce 323	Industrial Wastes	Sproul Woodard	4S	S'73	10
Ce 324	Public Health Engineering	Hall, Ghosh	3S	F'71	12
Ce 330	Sanitary Engineering Design I	Sproul	3S	F'70	10
Ce 331	Sanitary Engineering Design II	Woodard	3S	S'73	10
Ce 350	Sanitary Engineering Seminar	Staff	1S	F'72	12
Ce 351	Sanitary Engineering Seminar	Staff	1S	S'73	12

Mb 127	General Microbiology	Bain	3S	F'72	80
Mb 128	General Microbiology Lab.	Staff	2S	F'72	70
Mb 176	Virology	Buck	4S	S'73	20
Mb 231	Microbial Genetics	DeSiervo	3S	F'73	10
Mb 275	Tissue Culture Techniques & Mechanisms	Buck	4S	F'72	12
Ch 151	Organic Chemistry Lecture	Staff	3S	S'73	18
Ch 169	Physical Chemistry	Staff	4S	S'73	20
Zo 168	Limnology	Hatch	2S	S'73	15
Bt 299	Lake Ecology & Productivity	Davis	3S	F'72	10
Ba 301	Quant. Analysis for Business Decisions	Jensen	3S	F'72	30
Ms 133	Stochastic Processes	Staff	3S	S'73	15
Ms 167	Statistical Methods in Research	Staff	3S	F'72	12
Ms 169	Introduction to Computer Science	Staff	3S	S'73	20
Ms 193	Non-Linear Programming I	Staff	3S	S'73	15
ChE 160/162	Elements of Chemical Engineering	Chase	4S	S'73	10
ChE 168	Chemical Engineering Kinetics	Simard	3S	F'72	8
ChE 262	Mass Transfer	Ceckler	3S	S'73	10

Ce 178, 320, 323, 331, 350 and 351 and Mb 127 and 128 are required for all Master's students majoring in sanitary engineering.

Faculty

OTIS J. SPROUL
Professor
Department of Civil Engineering
1955

BS	University of Maine	Civil Engineering	1952
MS	University of Maine	Civil Engineering	1957
ScD	Washington University	Sanitary Engineering	1961

Industrial wastes, contemporary environmental pollution, inactivation of viruses, solid waste management, potato processing wastes, tannery wastes

100% (40% teaching, 50% research, 10% administration)

"Virus Removal by Adsorption in Wastewater Treatment Processes," Advances in Water Pollution Research, Proceedings, 4th International Conference, 541, 1969 (et al.)

"Investigations of Physical and Chemical Treatment Methods for Cattleskin Tannery Wastes," Journal Water Pollution Control Federation, 38, 4, 1966 (with P. F. Atkins and F. E. Woodard)

"The Contemporary Environmental Pollution Control Course at Maine," invited paper presented at the 1971 Annual Meeting, American Society for Engineering Education, Annapolis, Maryland

"The Inactivation of Poliovirus in Water by Ozonation," Journal Water Pollution Control Federation, accepted for publication, 1973 (with S. B. Majumdar and W. H. Ceckler)

"Effects of Chemical Ions on Virus Inactivation," US Public Health Service, Federal Water Quality Administration, and the US Environmental Protection Agency, 1963-71, principal investigator

"Potentiation Methods for Virus Inactivation by a Germicide," Department of the Army, Quartermaster Corps, 5/73-4/74, principal investigator

"Guidelines for Solid Waste Disposal in the State of Maine," Department of Environmental Protection, Augusta, Maine, 1973-74, co-principal investigator

Registered professional engineer: Maine

Member, American Society for Engineering Education; Vice Chairman and Chairman, Environmental Engineering Division (1968-70)
Member, Water Pollution Control Federation; Chairman, Subcommittee on Guidelines on the State of the Art of Advanced Wastewater Treatment Technology (1969-date)
Panel Review Member, National Science Foundation (1971-date)

WILLEM F. BRUTSAERT
Assistant Professor
Department of Civil Engineering
1973

Engr. Degree	University of Ghent (Belgium)	Soil Physics	1963
MS	University of Illinois	Agricultural Engineering	1967
PhD	Colorado State University	Civil Engineering	1970

Hydrology, flow through partially saturated media, water resources management

100% (60% teaching, 40% research)

"Laboratory Verification of Boundary Condition Assumptions of the de Saint-Venant Equations," Transactions American Society of Agricultural Engineers, 2, 5, 1968 (with R. N. Fenzl)

"A Functional Iteration Technique for Solving the Richards Equation Applied to Two-Dimensional Infiltration Problems," Water Resources Research, 7, 6, 1971

"Computer Analysis of Free Surface Well Flow," Journal Irrigation and Drainage Division, American Society of Civil Engineers, 97, IR3, 1971 (with E. A. Brietenbach and D. K. Sunada)

"An Analytical Interdisciplinary Evaluation of the Utilization of the Water Resources of the Rio Grande in New Mexico," Office of Water Resources Research, 7/70-date, co principal investigator

Previous full-time professional experience: 9 yrs. (3 yrs. academic and 6 yrs. research)

MRIGANKA M. GHOSH
Associate Professor
Department of Civil Engineering
1968

BTech (Hons)	Indian Institute of Technology (India)	Civil Engineering	1958
MS	University of Illinois	Sanitary Engineering	1962
PhD	University of Illinois	Sanitary Engineering	1965

Physicochemical and biological processes, aquatic chemistry, solid separation by porous media, water quality management

100% (50% teaching, 45% research, 5% administration)

"Bathophenanthroline Method for the Determination of Ferrous Iron," Journal American Water Works Association, 59, 7, 1967 (with J. T. O'Connor and R. S. Engelbrecht)

"Rate of Precipitation of Iron in Aerated Ground Waters," Journal Environmental Engineering Division, American Society of Civil Engineers, 92, SA1, 1966 (with J. T. O'Connor and R. S. Engelbrecht)

"Chemical Conditioning of Water for Controlling Quality Failures in Distribution Systems," Journal American Water Works Association, 65, 5, 1973

"Toxic Effects of Mercury on the Activated Sludge Process," Journal Water Pollution Control Federation, 45, 3, 1973 (with P. D. Zugger)

"A Study of the Physicochemical Parameters Affecting the Removal of Colloidal Particles from Water by Porous Media," Office of Water Resources Research, 7/71-date, principal investigator

"Causes and Effects of Water Quality Deterioration in Distribution Systems," Maine Water Utilities Association, 9/70-8/72, principal investigator

Previous full-time professional experience: 10 yrs. (3 yrs. consulting, 3 yrs. academic, and 4 yrs. research)

Member, Water Pollution Control Federation; Member, Standard Methods Committee (1972-date); Member, Research Committee (1972-date)
Member, American Water Works Association; Member, Student Activities Committee (1972-date)

MILLARD W. HALL
Associate Professor, Department of Civil Engineering and
Director, Land and Water Resources Center
1967

BS	Vanderbilt University	Civil Engineering	1962
MS	University of Illinois	Sanitary Engineering	1963
PhD	University of Illinois	Sanitary Engineering	1968

Sanitary microbiology, environmental health, lake eutrophication, removal of phosphorous in biologic systems

10% (research)

"Eutrophication: The Problem, Detection, Extent," Proceedings, Workshop-Conference in Reclamation of Maine's Dying Lakes, Conference Report No. 2, Water Resources Center, University of Maine, Orono, March 24-25, 1971

"Your Lakes Are Aging Too Fast," Maine Fish and Game, 13, 2, 1971

"Phosphorous Removal--Past, Present and Future," Water and Wastes Engineering, 6, 8, 1969 (with R. S. Englebrecht)

"Uptake of Soluble Phosphorous by Activated Sludge," presented at the 41st Annual Conference, Water Pollution Control Federation, Chicago, September 1968 (with R. S. Engelbrecht)

"Causes, Effects and Control of Lake Eutrophication," Office of Water Resources Research, 7/69-6/71, principal investigator

"Guidelines and Standards for Shoreland Zoning," Ford Foundation and Department of Environmental Protection, Augusta, Maine, 3/72-2/73

Previous full-time professional experience: 1 yr. (academic)

Member, AEEP
Member, Water Pollution Control Federation; Member, Subcommittee to Prepare Guidelines on the State of the Art of Advanced Wastewater Treatment Technology (1970-date)

FRANKLIN E. WOODARD
Associate Professor
Department of Civil Engineering
1968

BS	University of Maine	Civil Engineering	1961
MS	University of Maine	Civil Engineering	1963
PhD	Purdue University	Sanitary Engineering	1965

Design of water pollution control systems, air pollution control, river analysis, meat processing waste treatment, pulp and paper mill waste treatment

100% (50% teaching, 45% research, 5% administration)

"Electrically Induced Coagulation of Lignin from Kraft Mill Wastewater," Proceedings, 25th Purdue Industrial Waste Conference, Purdue University, Lafayette, Indiana, 1970 (with H. J. Campbell and D. O. Herer)

"Abatement of Pollution from a Poultry Processing Plant," Journal Water Pollution Control Federation, 44, 10, 1972 (et al.)

"A Statewide Study of Air Quality Problems," Proceedings, Annual Northeastern Regional Antipollution Conference, 1969 (et al.)

"Coacervation and Chemical Coagulation of Lignin from Pulp Mill Black Liquor," Journal Water Pollution Control Federation, 36, 11, 1964 (with J. E. Etzel)

"The Development and Implementation of Water Quality Monitoring and Control in the Lower Penobscot River Estuary," State Planning Office, State of Maine, 12/72-12/75, principal investigator

"Electrically Induced Coagulation of Lignin from Pulp Mill Bleach Plant Wastewater," Forest Products Research Laboratory, Madison, Wisconsin, 7/69-7/71, principal investigator

"A Study of Changing Environments of the Penobscot River Estuary," Ford Foundation, 9/70-8/72, research associate

Previous full-time professional experience: 1 yr. (research)

Member, AEEP

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Sanitary Engineering	Master's	10	6	9	4	10	4	8	5	6	5	ENROLLMENT
	Doctoral	1	0	1	0	2	0	2	0	5	0	

		69-70	70-71	71-72	72-73	73-74	
Sanitary Engineering	Master's	3	6	8	5	6	GRADUATES
	Doctoral	0	0	1	0	0	

Sanitary Engineering	Master's	0	NON-US NATIONALS
	Doctoral	0	

	Master's	Doctoral	
EPA traineeship	8	0	SUPPORT
Research assistantship	0	2	
Self supported	5	0	

Consulting	45	0	EMPLOYMENT (%)
R & D	5	0	
Industry	20	100	
Federal government	5	0	
Other government	20	0	
Military	5	0	

Facilities

The sanitary engineering laboratories are uniquely equipped to do animal virus inactivation and environmental monitoring work. Complete facilities are available to do any type of tissue culture work. Particle counting equipment is available for enumeration of micron-sized particles.

Manhattan College

Bronx, New York

Department of Civil Engineering
School of Engineering

Environmental Engineering
Environmental Science

ECPD Accredited--Environmental Engineering

Dr. John S. Jeris, Director
Environmental Engineering and Science Graduate Program
Manhattan College
Bronx, NY 10471
(212) 548-1400

May 1973

The primary purpose of this program is to provide the specialized knowledge and competence needed to analyze, design, and synthesize applied engineering systems for water pollution control and to participate as a professional person in water pollution control programs.

The specific educational aims of this graduate program are to develop a critical understanding of the scientific principles underlying the field of pollution control, the mathematic background required for the formulation and solution of engineering problems, an insight into the philosophy of design using scientific principles and mathematics, and the ability to read and understand advanced literature in the field of water pollution control.

The ME Degree is offered to students with an engineering undergraduate degree while an MS Degree is offered to others. The MS Degree includes a thesis or special topic requirement whereas the ME does not.

The college is a private institution with an enrollment of about 4,500 day and evening students. Approximately 800 students are enrolled in graduate studies. Tuition and fees for full-time graduate students in the environmental program average $2,300 for an academic year.

Admission Requirements

(a) 2.7/4 GPA.

(b) GRE is not required but can be helpful in admitting marginal students.

(c) Conditional admission with GPA of 2.3/4 is allowed based on strong senior performance, good recommendations, or years of professional experience. Students must maintain a 2.8/4 to remain in program.

(d) Foreign students must obtain a TOEFL score of 475 for admittance.

(e) All science and engineering disciplines at accredited institutions are acceptable provided the basic mathematics, chemistry, and physics were included in the curricula.

(f) During the first year, mathematics through differential equations and an undergraduate course in environmental engineering are required of nonengineers. These students also begin the graduate level courses in biology, chemistry, and other general courses during this introductory period.

(g) Applicants must have two letters of recommendation submitted from former professors.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
ME--Envir. Engr.	30S	No	No	2S	9
MS--Envir. Science	30S	No	No	2S	9

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 701	Mathematical Models	O'Connor	-	F'72	28
CE 702	Environmental Statistics	Thomann	-	F'72	15
CE 703	Mathematical Methods in Engineering	DiToro	-	F'72	8
CE 710	Sanitary Analysis	Jeris	-	F'72	10
CE 712	Organic & Physical Chemistry	Jeris	-	F'72	19
CE 714	Applied Microbiology	Heukelekian	-	S'73	20
CE 716	Unit Operations I	Mueller	-	F'72	21
CE 717	Unit Operations II	Mueller	-	S'73	17
CE 718	Biological Waste Treatment	Jeris	-	S'73	26
CE 720	Water Resources Hydraulics	O'Connor	-	S'72	14
CE 721	Hydrology & Oceanography	Thomann	-	S'72	17
CE 723	Analysis of Natural Water Systems I	O'Connor	-	F'72	28
CE 724	Analysis of Natural Water Systems II	O'Connor	-	S'73	24
CE 725	Systems Analysis & Water Quality Mgt.	Thomann	-	S'73	22
CE 727	Simulation Analysis	DiToro	-	S'73	12
CE 728	Water Resources	Staff	-	S'73	28
CE 730	Seminar	Mueller	-	S'73	18
CE 731	Special Topics	Staff	-	S'73	2
CE 732	Thesis	Staff	-	S'73	0
CE 408	Design of Treatment Systems	Stein	-	S'73	2

Bio 701	Aquatic Biology I	McFarlane	-	F'72	8
Bio 702	Aquatic Biology II	McFarlane	-	S'73	2

Faculty

JOHN S. JERIS
Director, Environmental Engineering and Science Graduate Program
Professor of Civil Engineering
1962

BS	Massachusetts Institute of Technology	Civil Engineering	1953
MS	Massachusetts Institute of Technology	Sanitary Engineering	1954
ScD	Massachusetts Institute of Technology	Sanitary Engineering	1962

Aerobic and anaerobic biological treatment systems for carbon and nitrogen removal

100% (50% teaching, 50% administration)

"Controlling Environmental Parameters for Optimum Composting," Compost Science, January-February 1973 (with R. W. Regan)

"Biochemistry of Methane Fermentation Using C-14 Tracers," Journal Water Pollution Control Federation, 37, 1965 (with P. L. McCarty)

"Still Wanted: Economical Controlled Denitrification," Water and Wastes Engineering, 8, June 1971

"Glucose Disappearance in Biological Treatment Systems," Applied Microbiology, 14, November 1966 (with R. R. Cardenas)

"The Biochemistry of Anaerobic Digestion," Federal Water Pollution Control Administration, 9/64-9/70, principal investigator

"Cellulose Degradation in Composting," US Public Health Service, 8/66-1/71, principal investigator

"Additives in Biological Treatment Systems," d-Con Company, 8/65-8/69, principal investigator

Registered professional engineer: New York and New Jersey

Previous full-time professional experience: 5 yrs. (3 yrs. consulting and 2 yrs. research and development)

Member, AEEP
Member, President's Council, New York Ocean Science Laboratory (1971-date)
Chairman, Program Committee, New York Water Pollution Control Association (1972-date)
Contributing Editor, Water and Wastes Engineering (1970-date)

DONALD J. O'CONNOR
Professor
Civil Engineering Department
1951

BCE	Manhattan College	Sanitary Engineering	1944
MCE	Polytechnic Institute of Brooklyn	Civil Engineering	1947
EngScD	New York University	Engineering Science	1956

Analysis of natural water systems; mathematical modeling of natural systems; stream, estuary, and ocean disposal of wastewater

100% (40% teaching, 60% research)

"Mechanism of Reaeration in Natural Streams," Transactions American Society of Civil Engineers, 123, pp. 641-684, 1958

"A Dynamic Model of the Phytoplankton Population in the Sacramento-San Joaquin Delta," Advances in Chemistry Series, No. 106, pp. 131-180, American Chemical Society, 1971

"The Temporal and Spatial Distribution of Dissolved Oxygen in Streams," Water Resources Research Journal, 3, 1, March 1967

"A Water Quality Model of the Great Lakes," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, SA4, August 1970 (with J. A. Mueller)

"Oxygen Balance of an Estuary," Journal Sanitary Engineering Division, American Society of Civil Engineers, 87, 1960

"Dynamic Water Quality Forecasting and Management," Federal Water Pollution Control Association-US Environmental Protection Agency, 7/1/68-12/31/72, principal investigator

"Estuarine Water Quality and Pollution," National Institute of Health, 6/64-5/69, principal investigator

Registered professional engineer: New York

Previous full-time professional experience: 8 yrs. (academic)

Member, AEEP
Diplomate, AAEE
Member, NOAA Committee on Model Environmental Systems Analysis and Committee Advisory to the Environmental Science Service Administration
Member, Smithsonian Institution Advisory Committee for Ocean Disposal of Waste for the Army Corps of Engineers
Member, National Academy of Science; Member, Board on Science and Technology for International Development; Member, Environmental Studies Board; Advisor to Panel on Marine Aquatic Life and Wildlife
Member, New York City Mayor's Science and Technology Advisory Council
Chairman, Education Committee, Association of Environmental Engineering Professors; Board of Directors; Member, Research Committee

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ROBERT V. THOMANN
Associate Professor
Environmental Engineering and Science Graduate Program
1966

BCE	Manhattan College	Sanitary Engineering	1956
MCE	New York University	Sanitary Engineering	1960
PhD	New York University	Physical Oceanography	1963

Application and utilization of systems analysis techniques, mathematical modeling, and economic and statistical analysis to stream, estuarine, and near-shore water quality management and water pollution control

100% (60% teaching, 40% research)

"Analysis of Variability in Waste Treatment Plant Performance Using Time Series Techniques," 2nd National Symposium on Sanitary Engineering Research, Cornell University, Journal Sanitary Engineering Division, American Society of Civil Engineers, June 1970

"Modeling of the Nitrogen and Algae Cycles in Estuaries," Proceedings, 5th International Water Pollution Conference, San Francisco, California, 1970 (with D. J. O'Connor and T. M. DiToro)

"Delaware River--A Case Study in Water Quality Management," Proceedings, International Symposium on River Ecology and the Impact of Man, Academic Press, 1972

Systems Analysis and Water Quality Management, Environmental Science Services Corporation, Environmental Research and Application, New York, 1972, 284pp

Previous full-time professional experience: 8 yrs. (government)

Member, AEEP
Member, Water Pollution Control Federation; Member, Research Committee
Research Reviewer, US Environmental Protection Agency

JAMES A. MUELLER
Assistant Professor
Environmental Engineering and Science Graduate Program
1969

BSE	Manhattan College	Civil Engineering	1962
ME	Manhattan College	Sanitary Engineering	1963
PhD	University of Wisconsin	Sanitary Engineering	1966

Principles and design of water and waste treatment processes, waste treatment kinetics modelling, mass transfer effects in treatment processes

100% (70% teaching, 30% research)

"Oxygen Theory in Biological Treatment Plant Design," Journal American Society of Civil Engineers, EE1, June 1973 (with T. J. Mulligan and D. M. DiToro) Gas Transfer Kinetics of Pure Oxygen System

"Biological Denitrification Using Fluidized Granular Beds," New York State Department of Environmental Conservation, Technical Paper No. 11, June 1972 (with C. Beer and J. S. Jeris)

"Oxygen Diffusion through Zoogleal Flocs," Biotechnology and Bioengineering, 10, 331, 1968 (with W. C. Boyle and E. N. Lightfoot)

"Biological Treatability of Various Air Force Industrial Wastes," Proceedings, 23rd Purdue Industrial Waste Conference, May 1968 (with W. W. Melvin)

"Benthal Oxygen Demands and Leaching Rates of Treated Sludges," Journal Water Pollution Control Federation, 44, pp. 2303-2315, 1972 (with W. J. L. Su)

Registered professional engineer: New York

Previous full-time professional experience: 3 yrs. (military)

Member, AEEP
Member, American Society of Civil Engineers
Member, Water Pollution Control Federation
Member, Education Committee, Association of Environmental Engineering Professors (1973-date)
Consultant, Hydroscience, Inc.

DOMINIC M. DITORO
Adjunct Assistant Professor
Civil Engineering Department
1967

BEE	Manhattan College	Electrical Engineering	1963
MA	Princeton University	Electrical Engineering	1965
PhD	Princeton University	Civil and Geological Engineering	1967

Application of mathematical and statistical analysis to stream, lake, estuarine, and coastal water quality analysis

50% (20% teaching, 30% research)

"A Dynamic Model of the Phytoplankton Population in the Sacramento-San Joaquin Delta," Advances in Chemistry Series, No. 106, American Chemical Society, 1971 (with D. J. O'Connor and R. V. Thomann)

"Preliminary Phytoplankton-Zooplankton Nutrient Model of Western Lake Erie," in press, 1973 (et al.)

"The Distribution of Dissolved Oxygen in a Stream with Time-Varying Velocity," Water Resources Research, 4, 3, pp. 634-646, June 1968 (with D. J. O'Connor)

"Maximum Entropy Mixing in Estuaries," Journal Hydraulics Division, American Society of Civil Engineers, 95, HY4, pp. 1247-1271, July 1969

"Recurrence Relations for First Order Sequential Reactions in Natural Waters," Water Resources Research, 8, 1, February 1972

Member, Site visitation team, University of Michigan, NOAA--Sea Grant (1973)
Associate Editor, Water Resources Research (1971-date)

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engr.	Master's	15	0	18	0	19	0	27	0	35	1	ENROLLMENT
Environmental Science	Master's	0	0	1	0	1	0	1	0	2	1	
Environmental Engr.	Master's	12		13		12		20		16		GRADUATES
Environmental Science	Master's	0		0		1		1		0		
Environmental Engr.	Master's	1										NON-US NATIONALS
Environmental Science	Master's	0										

	Envir. Engr. Master's	Envir. Science Master's	
EPA traineeship	28	2	SUPPORT
Lab assistantship	2	0	
University scholarship	2	1	
Government employer	2	0	
Self-supported	3	0	
Consultant employer	1	0	
Consulting	34	50	EMPLOYMENT (%)
R & D	3	0	
Industry	7	0	
Federal government	24	50	
Other government	16	0	
Further study	10	0	
Military	6	0	

Facilities

The environmental engineering and sciences laboratories at Manhattan College are a new modern facility made possible upon acquisition of newly acquired quarters in 1964 and encompass approximately 5,000 sq ft.

The water and wastewater laboratory has been equipped with standard and modern instrumentation and is intended for teaching as well as research. The laboratories are located in the Engineering Building which also houses the engineering library. Also, excellent machine shop services are available to the program. Various research and teaching equipment is included in the program's laboratories for use in the various physical, chemical, and biological processes that are studied. Permanent set-ups for teaching unit operations are available ranging in size from bench scale units to pilot plant size. In these laboratories is available individual lab desk space for each student to conduct analyses in sanitary chemistry and microbiology which is required for course work. Digital and analog computers are located in the engineering building and are used for teaching and research.

Marquette University

Milwaukee, Wisconsin

Civil Engineering Department
College of Engineering

Environmental Engineering

Professor William G. Murphy, Chairman
Civil Engineering Department
Marquette University
1515 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 224-7030

April 1974

The environmental engineering program at Marquette University is oriented such that the student can specialize in municipal and industrial wastewater treatment, water supply management, air pollution and public health. A close working relationship has been established with many of the nearby industries which allows the student an excellent opportunity to experience and work with real-world problems.

The University is a private co-educational school with approximately 10,000 students (60 percent men) from 50 different countries. There are about 900 undergraduate and 300 graduate students in the Engineering School attending classes during the day, evening, and co-op programs.

Marquette University is located in the city of Milwaukee which is on Lake Michigan. There are numerous parks and recreational facilities in the surrounding area. Fishing is especially good in the many nearby Wisconsin lakes and Marquette University consistently has a nationally ranked basketball team.

Admission Requirements

(a) 2.75/4 for MS.

(b) GRE is not required for US citizens.

(c) Conditional admission is possible for GPA down to 2.5/4 provided strong recommendations are submitted. Student must obtain an average grade of 3.0/4 with no grade lower than 2.0/4 in nine semester hours of course work to remain in the Graduate School.

(d) Foreign students must take TOEFL or the English Language Institute Test and show that they have an adequate language proficiency. The student should send his transcripts and three letters of recommendation directly to the Dean of the Graduate School.

(e) Any engineering discipline at an accredited institution is acceptable. Individuals with undergraduate degrees in chemistry and biology are also normally acceptable.

(f) Makeup courses are required as needed on an individual basis.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Environmental Engineering	30S	Yes	No	[a]	12
MS--Environmental Engineering	30S	No[b]	No	[a]	12

[a] A maximum of 6S of approved graduate course work may be transferred from another institution with the consent of the Dean and the Department Chairman; therefore 24S of course work are required for fulfillment of residence requirement.

[b] Master's essay is required but does not receive any formal credit.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CIEN 152	Environmental Sanitation	Staff	-	F'72	-
CIEN 154	Water & Wastewater Analysis	Staff	-	F'72	-
CIEN 158	Principles of Envir. Health Engr.	Staff	-	S'73	-
CIEN 159	Community Air Pollution	Staff	-	F'72	-
CIEN 160	Solid Waste Engineering	Staff	-	F'72	-
CIEN 183	Civil Engineering Systems Analysis	Staff	-	S'73	-
CIEN 192	Sanitary Engineering Biology	Staff	-	S'73	-
CIEN 250	Water Resources & Planning	Staff	-	-	-
CIEN 253	Principles of Water & WW Treatment I	Staff	-	F'72	-
CIEN 254	Principles of Water & WW Treatment II	Staff	-	S'73	-
CIEN 255	Principles of Water Chemistry	Staff	-	-	-
CIEN 256	Adv. Lab. in Water & WW Processes	Staff	-	S'73	-
CIEN 258	Industrial Waste Analysis & Treatment	Staff	-	F'72	-
CIEN 259	Adv. Treatment of Wastewater	Staff	-	S'73	-

CIEN 154, 253, 254, 256 and 258 are required of all environmental engineering majors and CIEN 192 is strongly recommended.

Faculty

RAYMOND J. KIPP
Dean, College of Engineering
1971

BS	Marquette University	Civil Engineering	1951
MS	University of Wisconsin	Sanitary Engineering	1957
PhD	University of Wisconsin	Sanitary Engineering	1965

Industrial wastes, laboratory analyses, combined overflow, planning and watershed studies

25% (20% research, 5% administration)

"Combined Overflow Study," City of Milwaukee, 1968-73

"Treatability of Paper Mill Wastes in Municipal Plants," Peshtigo, Appleton, Wisconsin, 1972-73

"Evaluation of Peat in Removal of Phosphates and Coliforms for Septic Tank Effluents," US Forest Service, Department of Agriculture, 1972

Registered professional engineer; Wisconsin

Previous full-time professional experience: 2 yrs. (government)

Member, AEEP
Member, American Society of Civil Engineers; President, Wisconsin Section (1971-72)
Consultant, Training Grant Site Visit Team, US Environmental Protection Agency (1970-date)

ALPHONSE E. ZANONI
Associate Professor
Civil Engineering Department
1964

BS	Marquette University	Civil Engineering	1956
MS	University of Minnesota	Civil Engineering	1960
PhD	University of Minnesota	Sanitary Engineering	1964

Biological wastewater treatment, sanitary engineering biology, solid waste treatment and disposal, water supply, environmental sanitation

100% (50% teaching, 50% research)

"Waste-water Deoxygenation at Different Temperatures," Water Research, 1, pp. 543-566, 1967

"Secondary Effluent Deoxygenation at Different Temperatures," Journal Water Pollution Control Federation, 41, 4, pp. 640-658, April 1969

"Chloride Interference in Nitrate-Nitrogen Determination," Journal American Water Works Association, 62, 9, pp. 568-571, September 1970

"Per Capita Loadings of Domestic Wastewater," Journal Water Pollution Control Federation, 44, 9, pp. 1756-1762, September 1972

"Ground Water Pollution and Sanitary Landfills--A Critical Review," Ground Water, 10, 1, pp. 3-13, January-February 1972

"Uptake of Phosphorus on Biological Slimes," US Environmental Protection Agency, 7/70-6/72, principal investigator

"Ground Water Pollution from Sanitary Landfills and Refuse Dump Grounds," Wisconsin Department of Natural Resources, 1971, principal investigator

"Eutrophic Evaluation of a Small Multi-land Use Watershed," University of Wisconsin, Water Resources Center, principal investigator

Registered professional engineer: Wisconsin

Previous full-time professional experience: 2 yrs. (consulting)

Member, American Society of Civil Engineers; Member, National Committee on Solid Waste Management (1972-date)
Member, Wisconsin Section, American Society of Civil Engineers; Chairman, Sanitary Technical Committee (1965-date)
Consultant, Review of Research Proposals, US Environmental Protection Agency (1971-date)

VLADIMIR NOVOTNY
Assistant Professor
Civil Engineering Department
1973

Diploma Engr.	Technical University (Brno, Czech.)	Sanitary Engineering	1963
Cand. of Sci.	Technical University (Brno, Czech.)	Sanitary & Water Resource Engr.	1968
PhD	Vanderbilt University	Environmental Engineering	1971

Water resources planning, water quality, solid waste treatment, wastewater treatment, hydrology, hydraulics

100% (50% teaching, 50% research)

"Mathematical Modeling of Water Quality Changes on a River Basin," 5th International Conference on Water Pollution Research, San Francisco, California, June 1970

"Heat Transfer in Turbulent Streams," Technical Report, Department of Environmental and Water Resources Engineering, Vanderbilt University, 1971 (in print) (with P. A. Krenkel)

"Simplified Mathematical Model of Temperature Changes in Rivers," Journal Water Pollution Control Federation, 45, 1973 (with P. A. Krenkel)

"Physical, Chemical, and Biological Treatment of a Latex Emulsion Waste Water," Purdue Industrial Waste Conference, 1972 (et al.)

"Evaporation and Heat Balance in Aerated Basins," 74th National Meeting, American Institute of Chemical Engineers, New Orleans, March 11-15, 1973, and AIChE, "Water 73"

Registered professional engineer: Wisconsin

Previous full-time professional experience: 5 yrs.

Member, AEEP
Member, Water Pollution Control Federation
Member, International Association on Water Pollution Research
Member, American Society of Civil Engineers

JACK E. PETERSON
Associate Professor, Civil Engineering Department (Marquette University)
Associate Professor, Environmental Medicine Department (The Medical College of Wisconsin)
1968

BS	Washington State College	Chemical Engineering	1951
MS	University of Michigan	Chemical Engineering	1952
PhD	University of Michigan	Industrial Health	1968

Human inhalation toxicology of carbon monoxide and solvents, environmental health engineering, air pollution, computerized data gathering

100% (60% research, 40% teaching)

"Absorption and Elimination of Carbon Monoxide by Inactive Young Men," American Medical Association Archives of Environmental Health, 21, 1970 (with R. D. Stewart)

"Experimental Human Exposure to Methylene Chloride," American Medical Association Archives of Environmental Health, 25, 1972 (et al.)

"Experimental Evaluation of Heat Stress Indices," American Industrial Hygiene Association Journal, 31, 1970

"Study on the Effects of Carbon Monoxide on Human Behavior and Performance," Coordinating Research Council, Inc, 9/68-11/73, co-investigator

"Study on the Effects of Low Concentrations of 1,2-dibromotetrafluoroethane (Halon 2402), Bromochlorodifluoromethane (Halon 1211), and Bromotrifluoromethane (Halon 1301) on Human Performance," Firepro, Inc., 6/71-5/72, co-investigator

Registered professional engineer: Wisconsin

Previous full-time professional experience: 13 yrs. (industry)

Member, American Industrial Hygiene Association; Chairman Hygienic Guides Committee (1969-date)
Member, Milwaukee County Advisory Board of the Department of Air Pollution Control (1970-date)
Co-chairman, Technical Advisory Committee, Southeastern Wisconsin Coalition for Clean Air (1969-72)
Chairman, State of Wisconsin Spray Coating Code Advisory Committee (1968-date)

CLIFFORD J. CRANDALL
Assistant Professor
Environmental Engineering
1968

BS	Marquette University	Civil Engineering	1962
MS	Northwestern University	Sanitary Engineering	1964
PhD	Illinois Institute of Technology	Sanitary Engineering	1967

Water chemistry, coagulation control methods, industrial wastewater treatment

100% (50% teaching, 50% research)

"Foam Separation of Colloidal Particles," Journal Applied Chemistry, 17, p. 163, June 1967

"Water Clarification by Foam Separation," Journal Water and Sewage Works, 13, 11, p. 432, 1966

"Foam Separation of ABS and Other Surfactants," Journal Air and Water Pollution, 8, p. 501, November 1964

"Foam Separation Behavior of Aqueous Suspensions of Clays and/or Iron," Water Research, 2, 12, p. 817, 1968 (with R. B. Grieves)

Registered professional engineer: Wisconsin

ARUN CHATTERJEE
Assistant Professor
Transportation Engineering and Urban Planning

PhD	North Carolina State University	Transportation Engineering	1970

Environmental engineering as related to urban planning, systems analysis
5%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Envir. Engr.	Master's	10	-	9	18	9	18	10	19	10	17	ENROLLMENT
Envir. Engr.	Master's	5		9		7		4		9		GRADUATES
Envir. Engr.	Master's	2		NON-US NATIONALS								

	Master's	
EPA traineeship	9	
Teaching assistantship	1	
Government employer	5	SUPPORT
Industrial employer	10	
Consultant employer	1	
Self-supported	1	
Consulting	50	
R & D	5	
Industry	7	
Federal government	2	EMPLOYMENT
Other government	16	(%)
Academic	1	
Further graduate study	14	
Unknown	5	

Facilities

Marquette University has exceptional facilities for research in the biological and chemical characterization of water and wastewater. In addition to the equipment needed for conventional environmental engineering analyses, the laboratory contains numerous sophisticated instruments such as Warburg respirometer, zeta meter, atomic absorption unit, infrared spectrophotometer, and two gas chromatographs.

University of Massachusetts

Amherst, Massachusetts

Civil Engineering Department
School of Engineering

Civil Engineering
Environmental Engineering

Dr. Tsuan H. Feng
Department of Civil Engineering
University of Massachusetts
Amherst, MA 01002
(413) 545-0685

February 1974

The environmental engineering program is administered within the Department of Civil Engineering. For a number of years students have been able to enroll for the MS and PhD in civil engineering. In 1968 the MS and PhD degrees in environmental engineering were instituted to provide enrollment opportunities to students with non-civil engineering backgrounds. Expansion in the environmental engineering program has evolved along interdisciplinary lines. There are now eighteen faculty associated directly with the program, eleven from the Department of Civil Engineering and the remainder from the Departments of Chemical Engineering, Mechanical Engineering, and Public Health.

The overall objective of the program is to prepare students for careers in engineering related to the development of a better environment. This requires understanding of water, air, and solid waste treatment and disposal, inasmuch as the processing of waste in one medium usually results in transfer of a by-product to one or both of the other media. Accordingly, the environmental engineering Master's curriculum requires each student to take a common core of fundamentals in the three media, while allowing him to pursue a subsequent specialty, in consultation with his advisor, and in keeping with his career goals. The PhD program has considerable flexibility to accommodate students who have been trained in various disciplines.

The Water Resources Research Center works closely with the School of Engineering through support of research, expansion of educational programs, and participation in public service efforts. The interests of the center in the social, economic, and ecological fields contribute to an enlargement of engineering concepts and provide engineers with an improved understanding of how their vitally important function fits into the broad area of social needs.

The University of Massachusetts is the state university of the Commonwealth. Situated in one of the most picturesque sections of the state, the University at Amherst joins with its academic neighbors--Amherst, Hampshire, Mount Holyoke, and Smith Colleges--in maintaining the rich tradition of education and cultural activity associated with the Connecticut Valley region. The Amherst campus consists of approximately 1,100 acres of land and 110 buildings. Physical growth has been carefully planned with provision for additional buildings and facilities to accommodate an enrollment of approximately 25,000 students by 1975. Tuition and fees for full-time graduate students average $1,100 for nonresidents and $700 for Massachusetts residents (academic year basis).

Admission Requirements

(a) 2.75/4 for admission to Graduate School.

(b) GRE score of 600 is required; advanced examination is not required.

(c) Admission to Master's program is possible for GPA down to 2.5/4 provided strong recommendations are submitted and department graduate student quota is not filled. Student must obtain a 3.0/4 in first semester to obtain full graduate student standing.

(d) Foreign students must score a minimum of 550 on the Standard English Comprehensive Examination to be admitted.

(e) Any engineering discipline at an accredited institution is acceptable. Individuals with undergraduate degrees in physical sciences, natural sciences, and public health are also encouraged to apply.

(f) Individuals having a baccalaureate in fields other than engineering must satisfy the mathematics and science requirements which are normally specified in an accredited undergraduate program.

(g) Applicants must have two letters of recommendation submitted from former professors in academic major.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	31S	Optional	No	1S	12
PhD--Envir. Engr.	80S	Yes	No	2S	42

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 556	Introduction to Hydrodynamics	Colonell Carver	3S	F'72	10
CE 561	Open Channel Flow	Higgins	3S	S'73	12
CE 575	Atmospheric Dispersion of Pollution	Halitsky	3S	F'72	15
CE 660	Hydrology	Higgins	3S	F'72	15
CE 662	Water Resources Engineering	Higgins	3S	S'73	17
CE 665	Environmental Institutions & Policies	Adrian Berger	3S	S'73	34
CE 669	Environmental Engineering Technology	Staff	2S	F'72	20
CE 670	Adv. Envir. Engr. Principles	DiGiano	3S	F'72	20
CE 671	Industrial Wastes	Lindsey	3S	S'73	9
CE 672	Environmental Engineering Analysis I	Kuzminski	3S	F'72	15
CE 673	Environmental Engineering Analysis II	Kuzminski	3S	S'73	10
CE 674	Radiological Health Engineering	Marcus	3S	F'72	5
CE 675	Surface Water Quality Control	Feng	3S	F'72	18
CE 676	Solid Wastes	Kuzminski	3S	F'72	18
CE 700	Urban Diffusion	Halitsky	3S	S'73	5
CE 751	Fluid Mechanics of the Oceans	Colonell Mangarella	3S	F'72	10

CE 763	Subsurface Hydrology	Adrian	3S	S'73	5
CE 764	Coastal Engineering	Colonell Mangarella	3S	S'73	10
CE 770	Environmental Engineering Design	Staff	3S	S'73	6
CE 771	Unit Processes of Envir. Engr.	Lindsey	3S	S'73	13
CE 772	Unit Operations of Envir. Engr.	DiGiano	3S	S'73	16
CE 773	Air Sampling & Analysis	DiNardi Halitsky	3S	S'73	16
CE 774	Advanced Waste Treatment	DiGiano	3S	S'72	10
CE 775	Environmental Systems Simulation	Adrian	3S	F'72	5
CE 776	BioInstrumentation of Envir. Systems	Kuzminski	3S	S'73	4
CE 850/851	Seminar	Staff	1S	S'73	15
A&FE 581	Water Quality Economics	Foster	3S	S'73	10
ChE 660	Air Pollution Control Proc.	Kirk	3S	S'73	15
ChE 661	Chemical Engineering Analysis	Douglas	3S	S'73	15
ChE 700	Chemistry of Air Pollution	Vanpee	3S	S'73	6
ME 577	Internal Combustion Engines	Ambs	3S	F'72	10
PH 632	Introduction to Air Pollution	Peters	3S	F'72	30
PH 661	Environmental Health I	Peters	3S	S'73	35
PH 662	Environmental Health II	Peters	3S	F'73	25

CE 665, 669, 670, 850 and 851 and one of the following: CE 672, 673, 770, 773, 776, are required of all environmental engineering majors. Either a 2-3 credit special problem or 6 credit thesis is also required.

Faculty

DONALD DEAN ADRIAN
Professor
Civil Engineering
1967

BA	University of Notre Dame	Liberal Arts	1957
BS	University of Notre Dame	Civil Engineering	1958
MS	University of California-Berkeley	Sanitary Engineering	1959
PhD	Stanford University	Civil Engineering	1964

Environmental systems analysis, land disposal of wastes, regional planning, sludge dewatering

100% (50% teaching, 25% research, 10% administration, 15% service)

"Analytical Solutions of Dye Diffusion Equations," Journal Environmental Engineering Division, American Society of Civil Engineers, 99, EE3, June 1973 (with R. W. Cleary)

"Analytical Solution of the Convective-Dispersive Equation for Cation Adsorption in Soils," Soil Sciences Society of America Proceedings, 37, 2, April 1973 (with R. W. Cleary)

"Dewatering Physical-Chemical Sludges," New Concepts in Physical-Chemical Wastewater Treatment (W. W. Eckenfelder and L. Cecil, eds.), Pergamon Press, 1972 (with J. E. Smith, Jr.)

"Disposal of Wastes from Water Treatment Plants: Report on Current Technology and Costs," Journal American Water Works Association, 61, 12, 1969 (with J. H. Nebiker)

"Regional Wastewater Management Systems," Developments in Water Quality Research (Hillel I. Shuval, ed.), Ann Arbor-Humphrey Science Press, 1970 (et al.)

"A Methodology for Planning Optimal Regional Wastewater Management Systems," US Department of the Interior, Office of Water Resources Research, 7/68-4/73, principal investigator

"Suitability of New England Soils in Accepting Waste Effluents," US Department of the Interior, Office of Water Resources Research, 7/73-1/75, principal investigator

"Sludge Thickening," US Environmental Protection Agency, 9/72-8/74, principal investigator

Registered professional engineer: Tennessee

Previous full-time professional experience: 2 yrs. (government)

Member, Water Pollution Control Federation; Member, Technical Practice Committee
US Environmental Protection Agency Office of Research and Monitoring Extramural Reviewer
Member, Lower Pioneer Valley Regional Planning Commission
Member, Environmental Impact Group

BERNARD B. BERGER
Professor
Civil Engineering
1966

BS	Massachusetts Institute of Technology	Public Health Engineering	1935
MS	Harvard University	Sanitary Engineering	1948

Water resources planning, environmental impacts, environmental health

100% (20% teaching, 20% research, 60% administration)

"Formation of Public Policy on Issue of Out-of-Basin Diversion of Connecticut River Flood Waters to Boston Metropolitan Area," Publication No. 28, University of Massachusetts Water Resources Research Center, 1973 (*et al*.)

"Social and Ecologic Implications of Proposals for Out-of-Basin River Basins," *Journal Professional Activities*, Proceedings, American Society of Civil Engineers, *97*, 1971

"Engineering Evaluation of Virus Hazard in Water," *Journal Sanitary Engineering Division*, American Society of Civil Engineers, *96*, SA1, 1970 (report of Committee on Environmental Quality Management, B. B. Berger, Chairman)

"Federal Water Resources Research Program for Fiscal Year 1970," Federal Council for Science and Technology, Office of Science and Technology, 1969

"Determination of Decision-Making Processes in Water Resource Planning and Development: Connecticut River Basin," Office of Water Resources Research, 2/73-6/75, co-principal investigator

"Public Policy on Out-of-Basin Diversion of Connecticut River Flood Waters," Office of Water Resources Research, 7/69-6/73, principal investigator

"Evaluation of Information Transfer by Correspondence Conference," Office of Water Resources Research, 2/73-12/73, principal investigator

Registered professional engineer: Massachusetts

Previous full-time professional experience: 30 yrs. (4 yrs. consulting and 26 yrs. government)

Member, AEEP
Diplomate, AAEE
Member, International Association of Water Pollution Research; Vice President; Chairman, US National Committee for IAWPR
Member, American Society of Civil Engineers; Member and Past Chairman, Committee on Environmental Quality Management
Member, Water Pollution Control Federation; Member, Program Committee; Member, Task Force on International Affairs
Consultant, Office of Water, US Environmental Protection Agency
Member, Massachusetts Public Health Council

JOSEPH M. COLONELL
Associate Professor
Civil Engineering Department
1967

BS	University of Colorado	Civil Engineering	1958
MS	Washington State University	Civil Engineering	1962
PhD	Stanford University	Civil Engineering (Fluid Mechanics)	1966

Fluid mechanics, coastal and estuarine processes, hydrology, oceanography

40% (15% teaching, 25% research)

"Laboratory Simulation of Sea Waves," Journal Waterways and Harbors Division, American Society of Civil Engineers, 94, WW2, pp. 159-174, May 1968 (with B. Perry)

"Effects of Nonuniform Wave Energy in the Littoral Zone," Proceedings, 12th Conference on Coastal Engineering, 2, Washington, DC, pp. 767-786, September 1970 (with V. Goldsmith)

"Computational Methods for Analysis of Beach and Wave Dynamics," Proceedings, 2nd Annual Geomorphology Symposium, Binghamton, New York, pp. 199-222, October 1971 (with V. Goldsmith)

"Forms of Erosion and Accretion on Cape Cod Beaches," Proceedings, 13th Conference on Coastal Engineering, 2, Vancouver, British Columbia, pp. 1277-1291, July 1972 (with V. Goldsmith and P. Turbide)

"Hydrologic Response of Massachusetts Watersheds," Water Resources Bulletin, in press (with G. R. Higgins)

"Environmental Factors Affecting Management of Reservoir Water Quality," Office of Water Resources Research, 7/71-9/74, principal investigator

"Hydrologic Factors in the Determination of Watershed Yields," Office of Water Resources Research, 7/68-7/71, co-principal investigator

Registered professional engineer: California, Washington, and Massachusetts

Previous full-time professional experience: 2 yrs. (1 yr. industry and 1 yr. consulting)

Reviewer, Journal Waterways, Harbors, Coastal Engineering Division (American Society of Civil Engineers)
Reviewer, Journal Hydraulics Division (American Society of Civil Engineers)
Reviewer, Applied Mechanics Reviews

FRANCIS A. DIGIANO
Assistant Professor
Civil Engineering
1969

BS	University of Massachusetts	Civil Engineering	1964
MS	Tufts University	Sanitary Engineering	1965
PhD	University of Michigan	Sanitary & Water Resources Engr.	1969

Physical-chemical treatment processes, mathematical modeling in process design, basic undergraduate environmental engineering, natural water chemistry, sediment-water nutrient exchange processes

100% (50% teaching, 25% research, 10% administration, 15% service)

"Upgrading the Activated Sludge System by Addition of Powdered Carbon," Water and Sewage Works, Summer 1973 (with A. B. Scaramelli)

"Sorption Kinetics in Infinite-Bath Experiments," Journal Water Pollution Control Federation, 45, 4, 1973 (with W. J. Weber)

"Sorption Kinetics in Finite-Bath Systems," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SA6, 1972 (with W. J. Weber)

"Mathematical Modeling of Nutrient Transport," Water Resources Research Center, University of Massachusetts, Publication No. 17, 1971

"Joint Treatment of Textile Dyeing, Paper Coating and Municipal Wastewaters," Proceedings, 5th Mid-Atlantic Industrial Waste Conference, Drexel University, 1971 (with A. Morgenroth and T. H. Feng)

"Demonstration Plant Studies on Nutrient Removal from Wastewater by Primary Treatment," 6/70-6/73, Massachusetts Division of Water Pollution Control, co-principal investigator

"Suppression of Bottom Deposits--Water Recycling of Nutrients in Lakes," 6/70-6/73, Massachusetts Division of Water Pollution Control, co-principal investigator

"Suitability of New England Soils in Accepting Waste Effluents," 7/73-7/75, US Department of the Interior, Office of Water Resources Research, co-investigator

Member, AEEP
Member, Water Pollution Control Federation; Member, Advanced Wastewater Manual of Practice Committee
Member, Lower Pioneer Valley Regional Planning Commission--Environmental Impact Review
Member, Industrial Relations Committee, Association of Environmental Engineering Professors

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TSUAN HUA FENG
Professor
Civil Engineering
1951

BS	Pei-Yung University	Civil Engineering	1940
MS	University of Wisconsin	Civil Engineering	1946
PhD	University of Wisconsin	Civil Engineering	1950

Stream analysis, lake studies, an introductory course in environmental protection for nonengineers

100% (40% teaching, 20% research, 40% administration)

"Effects of Calcium Bicarbonate on Disinfection by Halogens," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SAI, 1972 (with L. N. Kuzminski and C. C. Liu)

"Joint Treatment of Textile Dyeing, Paper Coating and Municipal Wastewaters," Proceedings, 5th Mid-Atlantic Industrial Waste Conference, 1971

"Environmental Engineering Problems," 1970 Yearbook, Chinese Institute of Engineers, New York

"Sediment-Water Interchange of Plant Nutrients in Lakes," Water Resources Research Center, University of Massachusetts, Publication No. 16, July 1971 (with A. P. Asikainen and A. W. Manning)

"Taste Thresholds of Halogens in Water," Journal American Water Works Association, 65, pp. 363-368, May 1973 (et al.)

"Suppression of Bottom Deposits--Water Recycling of Nutrients in Lakes," 6/70-6/73, co-principal investigator

"Control of Benthic Deposits in Lakes," Office of Water Resources Research, completed in 1970

Registered professional engineer: Massachusetts

Member, Water Pollution Control Federation; Member, Research Committee (expired 1971); Member, Standard Methods Commiteee (expired 1971)
Member, US Environmental Protection Agency, Office of Research and Monitoring Extramural Review

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JAMES HALITSKY
Associate Professor
Civil Engineering
1971

BMechE	City College-New York	Mechanical Engineering	1940
MAeroE	New York University	Aeronatucial Engineering	1952
PhD	New York University	Meteorology & Oceanography	1970

Atmospheric dispersion of pollutants, atmospheric turbulence, wind tunnel modeling of atmospheric phenomena

100% (30% teaching, 2% research, 68% administration)

"Gas Diffusion Near Buildings," Transactions American Society of Heating, Refrigerating and Air Conditioning Engineers, 69, pp. 464-484, 1963

"A Method for Estimating Concentrations in Transverse Jet Plumes," International Journal of Air and Water Pollution, 10, 1966

"Low Wind Turbulence Statistics and Related Diffusion Estimates from a Site Located in the Hudson River Valley," Atmospheric Environment, 7, pp. 49-61, 1973 (with D. M. Leahy)

"Wind Tunnel and Field Correlation Experiments on Chimney Jets," US Atomic Energy Commission, 7/65-1/71, principal investigator

"Field Meterological Studies of the Indian Point Nuclear Power Plant Site," Consolidated Edison Company of New York, Inc., 1/68-1/71, project director

"Urban Diffusion Modeling of New York City," US Public Health Service, 1/64-9/67, co-director (field experiments)

Previous full-time professional experience: 31 yrs. (8 yrs. industry and 23 yrs. academic)

Member, Board of Directors, New England Consortium on Environmental Protection (1971-date); Chairman (1972-date)
Ad Hoc Member, Site Visit Team, US Environmental Protection Agency, Office of Air Programs, Office of Manpower Development (1969-70)
Consultant, US Environmental Protection Agency, Division of Meteorology (1968-70)
Atmospheric Environmental Consultant to industry and government agencies (1962-date)

GEORGE R. HIGGINS
Professor
Civil Engineering
1956

BS	University of New Hampshire	Civil Engineering	1948
SM	Massachusetts Institute of Technology	Hydraulics	1951

Fluid mechanics, engineering hydraulics, hydrology, water resources engineering

50% (40% teaching, 10% research and administration)

"Hydrologic Factors in Determination of Watershed Yield," Water Resources Research Center, Publication No. 20, Final Report Project WRB008, July 1971 (with J. M. Colonell)

"Hydrology Studies in Massachusetts," Water Resources Research Center, 1965-71, principal investigator WR-3 (1965) and co-investigator WRB008 (1968-71)

Previous full-time professional experience: 5 yrs. (3 yrs. industry and 2 yrs. consulting)

Member, American Society of Civil Engineers; Past President, Western Branch in Massachusetts
Charter Member, American Water Resources Association
Member, American Society for Engineering Education
Member, Connecticut River Watershed Council
Member, New England Water Works Association

LAWRENCE N. KUZMINSKI
Assistant Professor
Civil Engineering
1967

BA	University of Toronto	Organic Chemistry	1962
MA	University of Toronto	Organic & Food Chemistry	1964
PhD	University of Massachusetts	Food Science & Technology	1967

Water microbiology, water chemistry, instrumental analysis, solid wastes

100% (60% teaching, 30% research, 10% administration)

"Effect of Calcium Bicarbonate on Disinfection by Halogens," Journal Sanitary Engineering Division, American Society of Civil Engineering, 98, SA1, Proc. Paper 8722, February 1972 (with T. H. Feng and C. C. Liu)

"Taste Thresholds of Halogens in Water," Journal American Water Works Association, 65, 5, May 1973 (et al.)

"Interaction of Outboard Motors with the Aquatic Environment--Causative Factors," Journal Water Pollution Control Federation, scheduled for publication July 1973 (with T. P. Jackivicz, Jr.)

"Effect of Outboard Motor Subsurface Exhausts on Recipient Water Quality," Massachusetts Division of Water Pollution Control, 6/70-5/73, principal investigator

"Impact of Heavy Metals on the Aquatic Biota of Massachusetts Waters," Massachusetts Division of Water Pollution Control, 6/73-5/76, principal investigator

Member, American Water Works Association; Chairman, Committee on Prevention of Industrial, Commercial, and Agricultural Chemical Pollution of Water Resources (1970-73)
Member, Water Pollution Control Federation; Member, Standard Methods Committee (1972-date)

EDGAR ERNEST LINDSEY
Professor
Chemical Engineering
1949

BS	Georgia Institute of Technology	Chemical Engineering	1936
Dr of Eng	Yale University	Chemical Engineering	1940

80% (60% teaching, 20% research)

"Reverse Osmosis Treatment of Wastewaters," Progress Reports, EPA WQO Project 17050EHG (with W. L. Short)

"Deformation and Non-Newtonian Behavior in Suspensions of Deformable Spheres," Final Report on NSF Grant GK-1110, 1972 (with D. C. Chappelear and L. Emerle)

"Particle Size of Liquid-Liquid Dispersions by Light Scattering," Journal Polymer Science, Part C, 5, pp. 55-66, 1964

"Use of Membranes in Water Treatment," Water Resources Research Center Project WR-75, 9/72-9/74, co-investigator

Registered professional engineer: Massachusetts

Previous full-time professional experience: 7 yrs. (2 yrs. industry and 5 yrs. academic)

Member, AEEP
Diplomate, AAEE
Member, American Institute of Chemical Engineers
Member, American Society for Engineering Education
Member, Water Pollution Control Federation
Member, American Water Works Association; Member, Training Aids Committee
Member, Education Committee, Association of Environmental Engineering Professors; Member, Laboratory Manual Committee; Member, Operator Training Committee

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PETER A. MANGARELLA
Assistant Professor
Civil Engineering
1970

BSCE	Carnegie Mellon University	-	1965
MSCE	Stanford University	-	1966
PhD	Stanford University	-	1971

Thermal pollution from power plants, cooling tower plumes and fogging, numerical analysis of environmental diffusion problems

50% (20% teaching, 30% research)

"Offshore Nuclear Power Plants," National Science Foundation, 6/15/72-12/31/73, co-investigator

ROSCOE F. WARD
Associate Professor, Civil Engineering and
Associate Dean of Engineering
1968

BS	Oregon State University	Civil Engineering	1959
MS	Washington State University	Sanitary Engineering	1961
ScD	Washington University	Environmental & Sanitary Engr.	1963

Wastewater treatment, oxidation lagoons

15% (teaching)

"Activated Sludge Processes: Oxygen and Nutrient Requirements and Environmental Factors," Proceedings, Short Course in Waste Water Treatment, University of Massachusetts, 1970 (with Rolf T. Skrinde)

"Activated Sludge Processes: Conventional Processes and Modifications-Applications," Proceedings, Short Course in Waste Water Treatment, University of Massachusetts, 1970 (with Rolf T. Skrinde)

"Post Treatment for Activated Sludge Processes by Ion Exchange," Proceedings, Short Course in Waste Water Treatment, University of Massachusetts, 1970 (with Rolf T. Skrinde)

Registered professional engineer: Missouri

Previous full-time professional experience: 5 yrs. (academic)

Diplomate, AAEE
Member, American Society of Civil Engineers; Member, Control Group, Committee on Sanitary Engineering Research; Chairman, Task Committee on Policy Development Research

SALVATORE R. DINARDI
Assistant Professor
Public Health
1970

PhD	University of Massachusetts	Physical Chemistry	1971

Air sampling and analysis
20%

Students

	69-70		70-71		71-72		72-73		73-74		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master's	9	0	25	3	37	5	27	9	24	4	ENROLLMENT
Doctoral	8	1	12	1	8	2	10	2	10	1	

	69-70	70-71	71-72	72-73	73-74	
Master's	7	8	12	15	23	GRADUATES
Doctoral	0	3	2	1	3	

Master's	1	NON-US NATIONALS
Doctoral	4	

	Master's	Doctoral	
EPA traineeship	13	0	
Other traineeship	2	0	
Research assistantship	5	5	
Teaching assistantship	0	3	SUPPORT
Other university support	1	1	
Self-supported	1	0	
Industrial employer	1	0	

EMPLOYMENT (%)

	Master's	Doctoral
Consulting	50	80
R & D	2	0
Industry	3	0
Federal government	5	0
Other government	20	0
Academic	0	20
Further study	10	0
Military	10	0

Facilities

Over 12,000 square feet of working space is available for research and instructional use both at the main environmental engineering laboratories and at the new pilot plant waste treatment center.

Among the outstanding features of the main environmental engineering laboratories are (1) a well-equipped instrumentation room (including a total carbon analyzer, gas chromatographs, atomic spectrophotometers, and U-V, visible and infra-red spectrophotometers) and (2) an air sampling station housing sensitive meterological equipment, an integrating nephelometer, a continuous sulfur dioxide analyzer and specially equipped high volume air samplers.

The new pilot plant waste treatment center is located adjacent to the local wastewater treatment plant. Among the large-scale units (5 gallons per minute) currently being operated are chemical clarifiers, carbon adsorption columns, sand filters, a package activated sludge system, and plastic media and rock media biological filters; 1500 square feet of laboratory complement this facility.

In addition to these facilities, a well-equipped fluids mechanics laboratory permits study of air/water interface problems as well as dispersion phenomena. The new Graduate Research Center at the University houses an outstanding Physical Sciences Library and a University Computer Center that includes two CDC-3600 computers with time-sharing facilities.

University of Michigan-Ann Arbor

Ann Arbor, Michigan

Water Resources Program
College of Engineering

Sanitary Engineering
Water Resources Engineering
Water Resources Management
Water Resources Sciences

ECPD Accredited--Bachelor and Master of Science in Engineering

Dr. Walter J. Weber, Jr.
Chairman, Water Resources Programs
College of Engineering
University of Michigan
Ann Arbor, MI 48104
(313) ~~764-6487~~ 763-1464

Dr. Jack A. Borchardt
Professor of Civil and Sanitary Engineering
College of Engineering
University of Michigan
Ann Arbor, MI 48104
(313) 764-6487

June 1973

Programs of advanced study in environmneta1 engineering and water resources in the College of Engineering are centered in the Department of Civil Engineering and include programs in sanitary engineering, water resources engineering, water resources sciences, and water resources management. The MSE in sanitary engineering and MSE in water resources engineering programs are open to qualified candidates with a BS in any of the generally recognized fields of engineering. Emphasis is on development of both technological and socio-economic concepts required for solution of environmental and water resources problems. The MS in water resources sciences, under the general administrative direction of the University Water Resources Committee, is intended primarily for chemists who wish to specialize in water chemistry, biologists or bacteriologists who wish to specialize in aquatic biology, and mathematicians who wish to specialize in water resources systems analysis and design. The program in water resources management provides a working knowledge of the problems and approaches to managing the use and development of water resources and provides specialization in one of several major aspects of water management approved by the Water Resources Committee.

Joint programs leading to the combined degrees MSE (sanitary engineering) and MPH (public health) are available in cooperation with the School of Public Health. The work in the two schools is integrated into a single program and both degrees are awarded at the time of completion of the total program of study. A minimum of 66 credit hours of course work, including a research investigation, is required for the combined program of study.

The comprehensive integrated educational program in water resources and pollution control at Michigan is complemented by an equally comprehensive integrated research program under the University's Sea Grant Program and the University Great Lakes Research Division, which provide students with opportunities for exposure to multidisciplinary research in the several aspects of water resource development and water quality control. Additional opportunities for institutional cooperation are afforded by the University Institute for Environmental Quality.

The University is located in Ann Arbor, a city of about 100,000. Ann Arbor is about 35 miles west of Detroit on I-94 which permits easy access to events and special programs in the metropolitan area. The University's central campus is surrounded by residential and business sections, making the bicycle one of the most popular forms of locomotion.

Admission Requirements

(a) 3.0/4 undergraduate GPA.

(c) GPA requirements can be waived in certain circumstances.

(e) Undergraduate disciplines admissible without extensive prerequisites include: civil engineering, chemical engineering, mechanical engineering, chemistry, biology, and bacteriology.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MSE--Sanitary Engr.	30S	Optional[b]	No	2S	[a]
MSE--Water Resources Engr.	30S	Optional[b]	No	2S	[a]
MS--Water Resources Sciences	36S	[b]	No	2S	18
MS--Water Resources Management	48S	[b]	No	2S	24
PhD	Varies	Yes	No	6S[c]	36

[a] 12 months or 18 months with research option.

[b] Technical report.

[c] Beyond BS.

[d] Must satisfy requirements for Master's plus such additional formal course work as may be required. Also student must pass a comprehensive examination and an English proficiency examination before he can be accepted as a candidate for the degree.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 405	Civil Engineering Systems	Bulkley	3S	73-74	20
CE 420	Hydrology I	Brater	3S	73-74	55
CE 421	Hydraulics	Wylie	3S	73-74	-
CE 481	Sewage Treatment	Borchardt	2S	73-74	50
CE 482	Environmental Water Chemistry	Weber	3S	73-74	54
CE 485	Water & Wastes Engineering	Glysson	4S	73-74	48
CE 501	Legal Aspects of Engineering	Lipphart	3S	73-74	-
CE 520	Hydrology II	Brater	2S	73-74	-
CE 536	Critical Path Methods	Harris	3S	73-74	-
CE 523	Flow in Open Channels	Wylie	3S	73-74	-
CE 524	Advanced Hydraulics	Streeter	3S	73-74	-
CE 526	Design of Hydraulic Systems	Streeter	3S	73-74	-
CE 531	Cost Analysis & Estimation	Bidwell	3S	73-74	42
CE 542	Physiochemical Principles in Soils	Gray	3S	73-74	12
CE 580	Microbio-Engineering/MIC 434	Kempe	3S	73-74	50
CE 581	Chem. Envir. & Water Resources Engr.	Weber	3S	73-74	26
CE 582	Sanitary Engineering Design	Canale	3S	73-74	21
CE 583	Water Purification & Treatment	Borchardt	3S	73-74	24
CE 584	Waste Water Treatment	Borchardt	3S	73-74	31
CE 586	Industrial Waste Treatment	Borchardt	2S	73-74	20
CE 587	Industrial Bacteriology	Kempe	3S	73-74	15
CE 588	Water Resource Systems & Economics	Armstrong	3S	73-74	18
CE 589	Pol. Fac. Envir. Water Res. Engr.	Bulkley	3S	73-74	8

CE 590	Stream Analysis	Canale	3S	73-74	20
CE 591	Unit Operations Envir. Water Res.	Weber	3S	73-74	11
CE 685	Prob. Envir. Water Res. Engr.	Staff	[1]	73-74	9
CE 688	Envir. & Water Res. Engr.	Armstrong	3S	73-74	8
CE 690	Design for Water Quality	Canale	3S	73-74	9
CE 880	Sanitary Engr. Seminar	Canale	1S	73-74	16
CE 881	Water Resources Seminar	Weber	1S	73-74	10
CE 980	Envir. Water Resources Research	Staff	[1]	73-74	10
CE 990	Dissertation/Precandidate	Staff	[1]	73-74	5
CE 995	Dissertation/Candidate	Staff	[1]	73-74	10
AOS 442	Oceanography	-	4S	-	-
AOS 449	Marine Geology	-	4S	-	-
AOS 478	Marine Chemistry	-	3S	-	-
AOS 531	Marine Ecology	-	4S	-	-
Biostat 500	Introduction to Biostatistics	-	3S	-	-
Biostat 510	Data Processing	-	3S	-	-
Chem 447	Physical Methods of Analysis	-	2S	-	-
CCS 573	Automatic Programming	-	3S	-	-
Econ 480	Public Finance	-	3S	-	-
Econ 481	Government Expenditures	-	3S	-	-
Econ 587	Urban-Regional Economics I	-	3S	-	-
Econ 588	Urban-Regional Economics II	-	3S	-	-
EIH 500	Environment & Health	-	2S	-	-
EIH 502	Principles & Environmental Health	-	3S	-	-
EIH 504	Computer Applications	-	2-4S	-	-
EIH 506	Elements--Environmental Biology	-	4S	-	-
EIH 508	Radiation-Environment	-	2S	-	-
EIH 531	Environmental Chemistry	-	3S	-	-
EIH 533	Instrum. Meth. of Analysis	-	3S	-	-
EIH 542	Industrial Toxicology	-	2S	-	-
EIH 543	Ecological Toxicology	-	3S	-	-
EIH 544	Methods in Toxicology	-	3S	-	-
EIH 570	Water Quality Management	-	3S	-	-
EIH 571	Water Quality Management Practice	-	3S	-	-
EIH 573	Water Pollution Biology	-	3S	-	-
EIH 575	Water Bacteriology	-	2-3S	-	-
EIH 576	Microbial Ecology	-	2-4S	-	-
EIH 579	Analysis of Water Res. Systems	-	2-4S	-	-
EIH 631	Chemical Analysis of Water	-	3S	-	-
EIH 634	Methods of Chemical Analysis	-	3S	-	-
EIH 670	Advanced Water Science Engr.	-	2-6S	-	-
Geol 461	Introductory Geochemistry	-	3S	-	-
IPPS 472	Quant. Methods for Public Admin. II	-	3S	-	-
IPPS 555/ Econ 555	Economic Analysis for Public Admin. I	-	3S	-	-
IPPS 556/ Econ 556	Economic Analysis for Public Admin. II	-	3S	-	-
IPPS 573	Public Sector Systems Analysis	-	3S	-	-
IPPS 614	Legal Envir. of Public Admin.	-	3S	-	-
IPPS 629	Quant. Methods for Public Admin.	-	3S	-	-
IPPS 861	Legal Problems of Natural Res.	-	3S	-	-
Law 731	Legal Problems of Envir. Quality	-	2S	-	-
Law 792	Legal Problems of Envir. Quality: Water Resources	-	3S	-	-
NR 402	Conservation of Natural Resources	-	3S	-	-
NR 411	Ecology of Aquatic Resources	-	3S	-	-
NR 422	Biology of Fishes	-	4S	-	-
NR 423	Functional Ichthyology	-	3S	-	-
NR 425	Limnology	-	3S	-	-
NR 426	Limnology Laboratory	-	3S	-	-
NR 470	Natural Resource Economics	-	3S	-	-
NR 472	Water Resource Economics I	-	3S	-	-
NR 516	Aquatic Entomology	-	3S	-	-
NR 558	Water Res. Policy & Admin.	-	3S	-	-
NR 559	Political Theory & Resource Allocation: Simulation Models	-	3S	-	-
NR 567	Seminar in Economic Problems of Natural Resources Admin.	-	3S	-	-
NR 571	Regional Development I	-	4S	-	-

NR 572	Regional Development II	-	4S	-	-
NR 668	Adv. Natural Resources Econ. II	-	3S	-	-
Pol Sci 530	Political Envir. of Public Admin. I	-	3S	-	-
Pol Sci 531	Political Envir. of Public Admin. II	-	3S	-	-
Pol Sci 585	Public Organ. & Admin. I	-	3S	-	-
Pol Sci 586	Public Organ. & Admin. II	-	3S	-	-
Psych 583	Intro. to Survey Research I	-	3S	-	-
Psych 584	Intro. to Survey Research II	-	3S	-	-
Psych 684	Case Studies in Survey Research	-	3S	-	-
Zoo 443	Limnology	-	3S	-	-

Faculty

WALTER J. WEBER, JR.
Professor of Environmental and Water Resources Engineering
Chairman, Water Resources Program
Civil Engineering
1963

ScB	Brown University	Engineering	1956
ScM	Rutgers University	Sanitary Engineering	1959
AM	Harvard University	Chemistry & Biology	1961
PhD	Harvard University	Water Resources Engineering	1963

Water and wastewater treatment, physicochemical processes, water chemistry, unit operations, water reclamation

100% (80% teaching, 20% research)

Physicochemical Processes for Water Quality Control, Wiley-Interscience, John Wiley and Sons, Inc., New York, 1972

"Biologically-Extended Physicochemical Treatment," Proceedings, 6th Conference of the International Association on Water Pollution Research, Jerusalem, Pergamon Press Ltd., Oxford, 1972 (with L. D. Friedman and R. Bloom, Jr.)

"Sorption Kinetics in Infinite-Bath Experiments," Journal Water Pollution Control Federation, 45, 713, 1973 (with F. A. DiGiano)

"The Interaction of Silicic Acid with Iron (III) and Uranyl Ions in Dilute Aqueous Solution," Journal Inorganic and Nuclear Chemistry, 33, 2443, 1971 (with R. A. Porter)

Analysis of Industrial Wastewaters, Wiley-Interscience, John Wiley and Sons, Inc., New York, 1972 (with K. H. Mancy)

"Training Grant in Water Resources," US Environmental Protection Agency, 1968-75, principal investigator

"Analysis of Pollution from Marine Engines and Effects on the Environment," Boating Industries Association and US Environmental Protection Agency, 1971-73, principal investigator

"Predictive Methods for Adsorption from Waters and Waste Waters," National Science Foundation, 1972-74, principal investigator

Registered professional engineer: Rhode Island

Member, AEEP
Member, American Institute of Chemical Engineers
Member, American Society of Civil Engineers
Member, American Chemical Society
Member, American Water Works Association
Member, Water Pollution Control Federation

JACK A. BORCHARDT
Professor of Civil and Sanitary Engineering
Civil Engineering
1948

BSCE	University of Illinois	Civil Engineering	1940
MSCE	Carnegie Tech	Civil Engineering	1941
PhD	University of Wisconsin	Civil Engineering	1948

Municipal and industrial wastes, water treatment and design

100% (80% teaching, 20% research)

"Eutrophication--Causes and Effects," Journal American Water Works Association, 61, 6, 272, 1969

"Electrokinetic Phenomena in the Filtration of Algal Suspensions," Journal American Water Works Association, 61, 7, July 1969 (with J. W. Foess)

"Dialysis Separation of Sewage Digestion," Journal Sanitary Engineering Division, American Society of Civil Engineers, 95, SA5, pp. 907-928, October 1969 (with M. J. Hammer)

"Biological Waste Treatment Using Rotating Discs," Biotechnology and Bioengineering, Symposium No. 2, pp. 131-140, 1971

"Variations in Phosphorus Uptake by Algae," Environmental Science and Technology, 4, pp. 737-743, September 1970 (with H. S. Azad)

"Hormel Grant for Waste Water Treatment," George Hormel and Company, 1973-74, principal investigator

Registered professional engineer: Michigan and Ohio

Member, AEEP
Member, American Society of Civil Engineers
Member, Education Committee Water Supply Division Section II, Water Analysis and Testing
Member, Water Pollution Control Federation
Member, American Water Works Association
Member, Sigma Xi

JOHN M. ARMSTRONG
Associate Professor of Environmental and Water Resources Engineering
Civil Engineering
1967

BS	The University of Michigan	Engineering	1959
MS	The University of Michigan	Engineering	1960
PhD	The University of Michigan	Operations Research/Systems Analysis in Water Resources	1969

Water quality management, regional water quality systems analysis, mathematical models in water resource systems, economics and financing of wastewater systems, coastal zone management

100% (33% teaching, 33% research, 33% administration)

"Optimal Location Theory in Wastewater Treatment Systems," 44th Annual Meeting of the Operations Research Society of America, November 1973 (with R. C. Wilson and J. Hsu)

"State Environmental Utilities for Waste Management," Journal Water Pollution Control Federation, 44, 9, September 1972

Chapter in The Waters Edge: Critical Problems of the Coastal Zone, Massachusetts Institute of Technology Press, October 1972

"Ecological and Systems Planning for the Great Lakes," Journal Water Pollution Control Federation, 43, 1, December 1971 (with J. T. McFadden)

"Systems Analysis Dimensions of Water Resources Management," Proceedings, American Water Resources Association Conference, Columbus, Ohio, March 1970

"Assessment of Land Disposal of Wastewater," US Environmental Protection Agency, 1972-75, principal investigator

"Shoreland Protection System," Michigan Department of Natural Resources, 1973-74, co principal investigator

"Urban Coastal Zone Research," City of Chicago, 1973-74, principal investigator

Member, American Society of Civil Engineers
Member, Marine Technology Society
Member, Sigma Xi
Member, International Association for Great Lakes Research
Member, Operations Research Society of America

ERNEST F. BRATER
Professor of Hydrology and Hydraulic Engineering
Civil Engineering
1940

BS	University of Michigan	Civil Engineering	1934
MSE	University of Michigan	Hydraulics	1936
PhD	University of Michigan	Hydraulics & Hydrology	1938

Surface and groundwater hydrology

100% (80% teaching, 20% research)

"Ludington Pumped Storage Project, Lake Front Model," June 1970 (with R. Wallace)

"Wave Forces on Submerged Pipe Lines," Proceedings, 13th International Conference on Coastal Engineering, American Society of Civil Engineers, January 1973 (with R. Wallace)

"A Hydrologic Model for Estimating Inflows and Outflows from Grand Traverse Bay," Technical Report No. 32, Michigan Sea Grant Program, August 1972

"Engineering Study of Shore-Erosion in the Lower Peninsula of Michigan," Report to Michigan Water Resources Commission, December 1971 (with Erwin Seibel)

"Prediction of Magnitude and Frequency of Floods in Michigan," Research Report submitted to US Bureau of Public Roads and Michigan Department of State Highways, August 1971 (with J. D. Sherrill)

"Hydrology and Shore-Erosion Sub-Project," University Sea Grant Program, 1972-73, principal investigator

"Ground Water Pollution Sub-Project," University Sea Grant Program, 1972-73, principal investigator

Registerered professional engineer: Michigan

Member, American Society of Civil Engineers; Member, Council on Wave Research
Member, American Geophysical Union
Member, American Shore and Beach Preservation Association
Member, International Association for Hydraulic Research
Member, International Oceanographic Foundation

JONATHAN W. BULKLEY
Associate Professor of Environmental and Water Resources Engineering
Civil Engineering
1968

SB	Massachusetts Institute of Technology	Civil Engineering	1961
SB	Massachusetts Institute of Technology	Political Science	1961
SM	Massachusetts Institute of Technology	Civil Engineering	1963
PhD	Massachusetts Institute of Technology	Political Science	1966

Applications of advanced computer techniques to the analysis of water resource problems with special emphasis on the political problems associated with implementation of water resource projects and programs

100% (80% teaching, 20% research)

"Simulation of Political Interaction in Multiple-Purpose River Basin Development," Department of Civil Engineering, Massachusetts Institute of Technology, 1966

"Validation of Political Simulation Models: Water Resource Projects," 6th American Water Resource Conference, Las Vegas, October 1970 (with Mrs. Julie Antill)

"Modelling Decision Effectiveness: Application to Water Resource Systems," Proceedings, International Symposium on Modelling Techniques in Water Resources Systems, 2, Ottawa, Canada, May 1972

"Environmental Sciences Engineering: A New Bachelor of Science in Engineering Program at the University of Michigan," Proceedings, 7th Annual American Association of Professors in Sanitary Engineering Workshop, University of Toronto, August 1972

"Institutions and Urban Water Management: A Systems View," in Institutions for Urban-Metropolitan Water Management: Essays in Social Theory (Normal Wengert, ed.), Colorado State University, November 1972

"Public Policy and Institutional Interaction," Sea Grant, 1972-73, principal investigator

"A Case Study of the Implementation of the Michigan Bond Issue for Water Pollution Control," Institute of Water Research, Michigan State University, 1972-73, principal investigator

"Program in Engineering for Public Systems," Sloan Foundation, principal participant

Previous full-time professional experience: 2 yrs. (government)

Member, American Society of Civil Engineers
Member, American Association for the Advancement of Science
Member, American Political Science Association
Member, Midwest Political Science Association

RAYMOND P. CANALE
Associate Professor of Civil Engineering
Civil Engineering
1968

BS	Syracuse University	Civil Engineering	1964
MS	Syracuse University	Sanitary Engineering	1966
PhD	Syracuse University	Sanitary Engineering	1968

Biological kinetics, stream and estuary analysis

100% (80% teaching, 20% research)

"An Analysis of Models Describing Predator-Prey Interaction," Biotechnology and Bioengineering, 12, pp. 353-378, 1970

Biological Waste Treatment, Wiley-Interscience Publishers, 1971

"Modeling the Spatial Distribution of Coliform in Grand Traverse Bay," Proceedings, 15th Conference on Great Lakes Research, April 1972 (with A. W. Green, Jr.)

"Field Verification and Application of a Model for Total Coliform Bacteria in Grand Traverse Bay," forthcoming Journal Water Pollution Control Federation

"Numerical Integration Aspects of a Nutrient Utilization Ecological Problem," Proceedings, AAS/SIAM Conference on Numerical Integration, Springer-Verlag, 1973 (with W. F. Powers and D. B. Frazho)

"Mathematical Modeling of Biological Production," Sea Grant, project director

"Application of Optimal Control Theory in Modeling Nutrient Utilization and Phytoplankton Production in Lakes," project director

Registered professional engineer: Michigan

Previous full-time professional experience: Government

Member, AEEP
Member, Chi Epsilon
Member, Water Pollution Control Federation
Member, Michigan Water Pollution Control Association
Member, American Society of Civil Engineers

EUGENE A. GLYSSON
Professor of Civil and Sanitary Engineering
Civil Engineering
1951

BSCE	University of Vermont	Civil Engineering	1949
MSE	University of Michigan	Sanitary Engineering	1951
PhD	Drexel Institute of Technology	Environmental Engineering	1969

Solid waste management, sanitary engineering

100% (80% teaching, 20% research)

Short Course in the Collection and Disposal of Solid Wastes, World Health Organization, 1968 (with J. Vincenz)

"Technology of Solid Waste Disposal," Outline for Short Course for American Public Works Association, 1967

"Types and Characteristics of Incinerators," Proceedings, Solid Waste Conference, Wayne County, Michigan, 1966

"Extended Aeration," Proceedings, Seminar on Activated Sludge, University of Michigan, 1966

"Heat Balance and Design Parameters in the Incineration of Solid Wastes" at West Virginia University, January 1968

Registered professional engineer: Michigan

LLOYD L. KEMPE
Professor of Chemical Engineering and Microbiology
Chemical Engineering
1952

BChE	University of Minnesota	Chemical Engineering	1932
MS	University of Minnesota	Public Health Engineering	1938
PhD	University of Minnesota	Chemical Engineering	1948

Chemical engineering and microbiology

100% (80% teaching, 20% research)

"Lake Erie--Dying But Not Dead," Environmental Science and Technology, 1, pp. 212-218, 1967 (with J. W. Moffett and J. F. Carr)

"The Separation of Bacteria by Adsorption onto Ion-Exchange Resins: II Resolution of Binary Mixtures," in Chemical Engineering in Medicine and Biology (Daniel Hershey, ed.), Plenum Press, New York, pp. 391-415, 1967 (with S. L. Daniels)

"Kinetics of the Conversion of Glucose to Gluconic Acid by Pseudomonas ovalis," Biotechnology and Bioengineering, 12, 2, pp. 273-290, 1970 (with Daniel N. Bull)

"Microbial Degradation of the Lamprey Larvicide 3-trifluoromethyl-4-nitrophenol in Sediment-Water Systems," Technical Report No. 18, Great Lakes Fishery Commission, Ann Arbor, Michigan

"High Temperature-Short Time (HTST) Processing of Suspensions Containing Bacterial Spores," Journal Food Science, 38, 3, pp. 168-172, 1973 (with R. A. Jacobs and N. A. Milone)

Registered professional engineer: Michigan and Minnesota

Member, AEEP
Diplomate, AAEE
Member, American Institute of Chemical Engineers
Member, American Chemical Society
Member, Society of American Microbiologists
Member, American Association for the Advancement of Science
Member, Water Pollution Control Federation

VICTOR L. STREETER
Professor of Civil and Hydraulic Engineering
Civil Engineering
1954

BSE	University of Michigan	Civil Engineering	1931
MSE	University of Michigan	Hydraulics	1932
ScD	University of Michigan	Hydraulics	1934

Hydraulic transients applied to various systems such as piping systems, open channel systems, and transient pore pressure in porous media (earthquake action on reservoirs and earth dams)

100% (80% teaching, 20% research)

Discussion to "Automation in California's State Water Project" by R. R. Reynolds and W. R. Madsen, Journal Pipeline Division, American Society of Civil Engineers, 94, PL1, October 1968 (with E. B. Wylie)

"An Investigation of the Effect of Cavitation Bubbles on the Momentum Loss in Transient Pipe Flow," American Society of Mechanical Engineers, Paper No. 70-FE-4, presented at Fluids Engineering, Heat Transfer, and Lubrication Conference, Detroit, May 1970 (with M. E. Weyler and P. S. Larsen)

Fluid Mechanics (5th ed.), McGraw-Hill Book Company, New York, 1970

"Transients in Closed Conduit Systems," in Control of Flow in Closed Conduits (J. Paul Tullis, ed.) Colorado State University, Fort Collins, pp. 229-258, 1971

"Unsteady Flow Calculations by Numerical Methods," Journal of Basic Engineering, American Society of Mechanical Engineers, Transactions, pp. 457-466, June 1972

"Hydraulic Transients in Open and Closed Conduits," National Science Foundation, 1972-73, principal investigator

"Earthquake Induced Transient Pore Pressures in Earth Dams," National Science Foundation, 1972-74, principal investigator

Registered professional engineer: Michigan

Member, American Society of Civil Engineers
Member, American Society for Engineering Education
Member, American Society of Mechanical Engineers
Member, International Association for Hydraulic Research
Member, Sigma Xi

EVAN B. WYLIE
Professor of Hydrology and Hydraulic Engineering
Civil Engineering
1966

BS	University of Denver	Civil Engineering	1953
MS	University of Colorado	Civil Engineering	1955
PhD	University of Michigan	Hydraulics	1964

Fluid transients, hydrology, and water resource systems

100% (80% teaching, 20% research)

"Unsteady Free-Surface Flow Computations," Journal Hydraulics Division, American Society of Civil Engineers, 96, HY11, pp. 2241-2252, November 1970

Discussion of "Resonance in Pressurized Piping Systems" by M. H. Chaundry, Journal Hydraulics Division, American Society of Civil Engineers, 97, HY2, p. 380, February 1971

"Diesel Fuel Injection System Simulation and Experimental Correlation," Proceedings, Society of Automotive Engineers Meeting, Montreal, Canada, pp. 1855-1869, June 1971 (with J. A. Bolt and M. F. El-Erian)

"Pipeline Dynamics and the Pulsed Jet," presented at the International Symposium on Jet Cutting Technology, BHRA, Coventry, England, April 1972

"Unsteady Natural Gas Calculations in Complex Piping Systems," Paper #SPE 4004 presented at the 47th Annual Fall Meeting, Society of Petroleum Engineers of the American Institute of Mining, Metallurgical and Petroleum Engineers, San Antonio, Texas, October 1972 (with V. L. Streeter and M. A. Stoner)

EDWARD CALLENDER
Assistant Professor of Oceanography
PhD University of North Dakota Geochemistry 1968
Geochemistry of natural waters
100%

DAVID C. CHANDLER
Professor of Zoology
PhD University of Michigan Zoology 1934
Aquatic biology and limnology
100%

LYLE E. CRAINE
Professor of Natural Resources
PhD University of Michigan Conservation 1956
Water resources policy and institutional arrangements
100%

ROLF A. DEININGER
Associate Professor of Environmental and Industrial Health
PhD Northwestern University Sanitary Engineering 1965
Environmental systems analysis, water resources development, mathematical models, economics, computer techniques
100%

PHILIP J. ELVING
Professor of Chemistry
PhD Princeton University Chemistry 1937
Analytical chemistry in all of its phases, electrochemical behavior of biological compounds, chemistry in nonaqueous media
100%

JOHN J. GANNON
Professor of Public Health Engineering
MPH University of Michigan Public Health Engineering 1952
Health aspects of water quality
100%

ROLF HARTUNG
Associate Professor of Environmental and Industrial Health
PhD University of Michigan Wildlife Management 1964
Toxicology, ecology
100%

FRANK F. HOOPER
Professor of Fisheries and Zoology
PhD University of Minnesota - 1948
Aquatic biology
100%

JACK L. HOUGH
Professor of Meteorological and Oceanographic Engineering
PhD University of Chicago Geology 1940
Hydrogeology, geology of the Great Lakes
100%

KHALIL H. MANCY
Professor of Environmental Chemistry, Environmental and Industrial Health
PhD University of North Carolina Chemistry 1962
Environmental analytical chemistry
100%

MICHAEL D. MORRIS
Associate Professor of Chemistry
PhD Harvard University Chemistry -
Electrochemistry and analytical applications of organometallic compounds
100%

WILLIAM J. PIERCE
Professor of Law
JD University of Michigan Law 1949
Water law
100%

GUNTER SCHRAMM
Associate Professor of Resource Economics
PhD University of Michigan Natural Resources Economics 1967
Water resource economics, energy economics, regional development, government expenditure analysis
100%

Students

		69-70 FT PT	70-71 FT PT	71-72 FT PT	72-73 FT PT	73-74 FT PT	
Water Resources & Sanitary Engineering	Master's	22	20	28	30	25	
	Doctoral	8	12	11	12	14	
Water Resources Mgt.	Master's	4	6	8	7	6	ENROLLMENT
Water Resources Sciences	Master's	3	8	9	4	4	
	Doctoral	3	2	1	1	2	
Water Resources & Sanitary Engineering	Master's	20	20	26	29	22	
	Doctoral	3	3	3	2	2	
Water Resources Mgt.	Master's	4	4	4	4	5	GRADUATES
Water Resources Sciences	Master's	2	8	8	3	4	
	Doctoral	1	1	1	0	0	
Water Resources & Sanitary Engineering	Master's	2					
	Doctoral	4					
Water Resources Mgt.	Master's	1					NON-US NATIONALS
Water Resources Sciences	Master's	0					
	Doctoral	0					

	WR & SE	WR Mgt.	WR Sciences	
EPA traineeship (partial)	18	5	4	
Research assistantship	12	0	0	
Teaching assistantship	2	0	1	
Other university support (partial)	16	1	1	SUPPORT
Government employer (incl. military)	3	0	0	
Industrial employer	2	0	0	
Self-supported	2	0	0	
Consulting	25	10	10	
R & D	10	0	5	
Industry	25	8	5	
Federal government	10	30	25	
Other government	10	40	25	
Academic	5	0	15	
Further study	10	0	15	
Military (professional)	5	10	0	
Outside environmental area	0	2	0	

Facilities

The interdisciplinary Michigan water resources program combines the faculties and research and teaching facilities of the College of Engineering; the School of Public Health; the School of Natural Resources; the College of Literature, Science, and the Arts; and the Great Lakes Research Division. Among the University's unique research facilities are the two vessels MYSIS and the INLAND SEAS of the Great Lakes Research Division. In July 1973 the University started construction of a new Water Resources Engineering Building which is designed to be one of the most extensive and advanced research and teaching facilities in water resources and environmental engineering in the country.

Michigan Technological University

Houghton, Michigan

Civil Engineering Department
College of Engineering

Civil Engineering

ECPD Accredited--Civil Engineering

Dr. C. Robert Baillod
Associate Professor
Civil Engineering Department
Michigan Technological University
Houghton, MI 49931
(906) 487-2530

May 1973

The environmental engineering graduate program at Michigan Tech provides a choice of orientation toward either sanitary engineering or water resources. The more general water resources program combines courses in sanitary engineering, hydraulics, and hydrology with courses in resource management and planning.

Founded in 1885 as the Michigan School of Mines, Michigan Technological University is an independent unit in the State of Michigan's tax-supported system of higher education. The University has an enrollment of 5000 students (including 225 graduate students) with approximately 50 percent enrolled in the College of Engineering. The College of Engineering awards Bachelor's and Master's degrees in seven fields of engineering. In addition, the PhD is awarded in four fields.

The Civil Engineering Department has a large undergraduate program (500 students) and a small graduate program (20 students). Roughly half of these students major in the environmental area. The modest number of graduate students allows the faculty to work closely with each student in the development of course programs and theses. Supporting course work and thesis advice in the fields of microbiology, aquatic ecology, air pollution, thermal pollution, and unit operations are available through the Departments of Biological Sciences, Mechanical Engineering, and Chemical Engineering. Tuition and fees for full-time graduate students are $525 (residents) and $1,485 (nonresidents) per academic year.

Michigan Tech is located on the Keweenaw Peninsula which juts out into Lake Superior about 450 miles north of Chicago. The main campus stretches for about a mile along the shore of Portage Lake, a tributary of Lake Superior. The surrounding cities of Houghton and Hancock have a combined population of about 15,000 including the University. The area is known for its rugged unspoiled natural beauty and heavy snowfalls and has been nicknamed the "Copper Country" because of its rich history of copper mining.

Admission Requirements

(a) Minimum undergraduate GPA of 2.5/4.

(b) GRE is not required.

(c) No provisional admission is allowed.

(d) The minimum score on TOEFL is 500.

(e) Any engineering degree from an accredited institution is acceptable. Holders of nonengineering degrees will be required to take certain engineering prerequisites for which graduate credit is not available.

(f) Prerequisites required of nonengineers include math through differential equations and engineering mechanics through fluids.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	45Q[a]	Optional	No	[b]	12

[a] Including either a thesis of 9-15Q (recommended), or engineering report of 3-6Q, or all course work (available only in certain cases).

[b] 2/3 of graduate credits must be earned at Michigan Tech.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 451	Water & Wastewater Treatment	Baillod	3Q	W'73	40
CE 452	Examination of Water & Wastewater	Polta	3Q	S'73	36
CE 453	Environmental Health Engineering	Baillod	2Q	A'72	24
CE 454	Distribution & Collection Systems	Baillod	3Q	S'73	25
CE 467	Open Channel Hydraulics	Alger	3Q	W'73	17
CE 465	Hydraulic Machinery	Alger	3Q	S'73	12
CE 551	Sanitary Science & Public Health	Polta	3Q	W'73	10
CE 552	Industrial Waste Treatment	Baillod	3Q	S'73	11
CE 553	Advanced Sanitary Engineering I	Polta	4Q	A'72	5
CE 554	Advanced Sanitary Engineering II	Baillod	4Q	W'73	4
CE 555	Water Quality Hydrology	Polta	3Q	Su'72	8
CE 556	Advanced Sanitary Engineering III	Baillod	4Q	S'73	5
CE 561	Sediment Transport	Alger	3Q	A'71	6
CE 562	Dimensional Analysis & Similitude	Alger	3Q	A'69	3
CE 563	Irrigation & Flood Control	Alger	3Q	S'73	8
CE 564	Water Resources Engineering	Alger	3Q	W'72	10
CE 565	Ground Water & Seepage	Alger	3Q	S'68	2
CE 566	Advanced Hydraulic Laboratory	Alger	1Q	S'73	1
CE 591-93	Seminar	Polta	1Q	S'73	4
BL 420	Sanitary Bacteriology	Kahan	4Q	A'72	10
BL 470	Aquatic Ecology	Wright	4Q	S'73	25

BL 545	Physical & Chemical Limnology	Spain	4Q	W'73	7
ME 431	Air Pollution & Emissions Control	Johnson	3Q	W'73	20
ME 435	Thermal Pollution	Frea	4Q	W'73	20
ME 433	Acoustics & Noise Control	Evensen	4Q	New'73	-

Faculty

C. ROBERT BAILLOD
Associate Professor
Civil Engineering Department
1968

BCE	Marquette University	Civil Engineering	1963
MSCE	University of Wisconsin	Civil Engineering	1965
PhD	University of Wisconsin	Civil Engineering	1968

Biological waste treatment, industrial waste treatment, sanitary engineering design, air pollution control, water treatment

100% (80% teaching, 15% research, 5% administration)

"Hydraulic and Sedimentation Efficiencies of Tailings Clarification Basins," Proceedings, Purdue Industrial Waste Conference, 1972 (with F. B. Christensen)

"Mass Transfer Limitations in Substrate Removal," Journal Sanitary Engineering Division, American Society of Civil Engineers, p. 525, April 1970 (with W. C. Boyle)

"Wastewater Resulting from the Concentration of Low Grade Iron Ore," Water and Sewage Works, p. 359, October 1970 (with G. R. Alger and H. S. Santeford)

"Storage and Disposal of Wastewater Resulting from the Concentration of Low Grade Iron Ore," US Environmental Protection Agency and Cleveland-Cliffs Iron Company, 7/70-5/73, project director

"Nitrification in Surface Waters Tributary to Lake Superior," Office of Water Resources Research, 7/69-7/71, principal investigator

"Fate of N and P in Aerobic Sludge Digestion," Michigan Technological University, 6/72-10/72, principal investigator

Registered professional engineer: Michigan and Wisconsin

Previous full-time professional experience: 2 yrs. (government)

Member, AEEP
Member, American Society of Civil Engineers
Member, Water Pollution Control Federation
Member, American Water Works Association

GEORGE R. ALGER
Professor
Civil Engineering Department
1966

BSCE	Michigan Technological University	Civil Engineering	1956
MSCE	South Dakota State University	Civil Engineering	1960
PhD	Colorado State University	Civil Engineering	1964

Water resources, hydrology, snow hydrology, sediment transport, drainage

100% (80% teaching, 15% research, 5% administration)

"Snow Hydrology in the Lake Superior Region," Transactions, American Geophysical Union, 51, 4, April 1970 (with H. S. Santeford)

"Mine Tailings Basins and their Associated Watersheds," Proceedings "Watersheds in Transition" Series No. 14, American Water Resources Association, 1972 (with C. R. Baillod)

"Snowmelt Energy Exchange in Upper Michigan," *Water Resources Research*, *8*, 2, April 1972 (with H. S. Santeford)

"Storage and Disposal of Wastewater Resulting from the Concentration of Low Grade Iron Ore," US Environmental Protection Agency and Cleveland-Cliffs Iron Company, 7/70-5/73, grant director

"Hydrology of Mine Tailings Basins," Cleveland-Cliffs Iron Company, 5/68-12/69

Previous full-time professional experience: 8 yrs. (6 yrs. academic and 2 yrs. government)

Member, American Society of Civil Engineers
Member, American Geophysical Union
Member, American Water Resources Association

ROBERT C. POLTA
Assistant Professor
Civil Engineering Department
1970

BS	University of Minnesota	Civil Engineering	1961
MSCE	University of Minnesota	Civil Engineering	1964
PhD	University of Minnesota	Civil Engineering	1970

Land disposal of effluent, nitrogen and phosphorus removal, water treatment, solid waste disposal, oxygen transfer

100% (80% teaching, 15% research, 5% administration)

"Mechanical Surface Aeration of Receiving Waters," *Journal Water Pollution Control Federation*, *38*, 1, 1966 (with R. H. Susag and G. J. Schroepter)

"Septic Tank Effluents," *Water Pollution by Nutrients--Sources, Effects and Control*, Proceedings of Minnesota Soil Conservation Society 1969, Water Resources Research Center Bulletin No. 13, University of Minnesota, 1969

"Discussion of Underground Movement of Nitrogen," *Advances in Water Pollution Research*, Proceedings of 3rd International Conference at Munich, *1*, 1966

"Test Program on the Removal of Phosphorus at the Minneapolis-St. Paul Sanitary District Plant," Minneapolis-St. Paul Sanitary District, 9/69-9/70, co-principal investigator

"Control of Nitrate Contamination of Groundwater Associated with Land Disposal of Municipal Sewage," Office of Water Resources Research, 7/71-9/72, principal investigator

"Reaeration and Recovery Rates of the Mississippi River in the Hastings Pool," Minneapolis-St. Paul Sanitary District, 4/70-9/70, co-principal investigator

Registered professional engineer: Michigan

Member, American Water Works Association
Member, Water Pollution Control Federation
Member, American Public Works Association

THOMAS D. WRIGHT
Assistant Professor
Biological Sciences Department
College of Science and Arts

PhD	University of Wisconsin	Limnology	1968

Limnology, aquatic ecology, water chemistry, fish biology
50%

JAMES D. SPAIN
Professor
Biological Sciences Department
College of Science and Arts
PhD Stanford University Biochemistry 1956
Physical and chemical limnology, water chemistry, mixing processes in lakes
30%

JOHN H. JOHNSON
Associate Professor
Mechanical Engineering Department
PhD University of Wisconsin Mechanical Engineering 1964
Air pollution and emissions control, energy conversion
40%

DAVIS W. HUBBARD
Associate Professor
Chemical Engineering Department
PhD University of Wisconsin Chemical Engineering 1964
Mass transfer, mixing processes in lakes, thermal phenomena in lakes
25%

Students

	68-69		69-70		70-71		71-72		72-73		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master's	3	-	3	-	6	-	7	-	8	-	ENROLLMENT
Master's	2		2		3		6		4		GRADUATES

Master's 0 NON-US NATIONALS

	Master's	
Teaching assistantship	2	SUPPORT
Government employer	1	
Self-supported	2	

State government	25	EMPLOYMENT (%)
Consulting	37.5	
Federal government	12.5	
Other government	12.5	
Industry	12.5	

Facilities

The Civil Engineering Department occupies three floors of the modern (1957) Civil-Geology Building. The environmental engineering laboratories occupy approximately 3000 sq ft on the second floor and are well equipped for water analysis and water and wastewater treatment studies. The hydraulics-hydrology laboratory occupies 5000 sq ft on three floors and is equipped with standard pumps, flumes, etc. and with several pieces of climatological and hydrologic data gathering instruments.

University of Minnesota

Minneapolis, Minnesota

Department of Civil and Mineral Engineering
Institute of Technology

Environmental Engineering

ECPD Accredited--Environmental Engineering

Dr. Walter K. Johnson, Associate Professor
Department of Civil and Mineral Engineering
112 Mines and Metallurgy Building
University of Minnesota
Minneapolis, MN 55455
(612) 373-2514

February 1974

The graduate program in environmental engineering in the Department of Civil and Mineral Engineering offers programs in water supply and treatment, water pollution control, and solid wastes management. At the Master's level either the MSCE or the professional MCE degree is offered. The programs differ in that the MSCE degree may be either with or without a research thesis and the MCE degree includes a professional design project similar in scope to the MS thesis. Qualified students may also work toward the PhD degree. Depending on the student's interest, programs are flexible in order to pursue objectives ranging from management and monitoring to design oriented work. Other groups and departments at the University provide excellent opportunities for study in related fields such as air pollution control, radiological health, environmental health, hydrology, limnology, fluid mechanics, chemistry, biochemistry, chemical engineering, microbiology, business, law, public administration, mathematics, and computer information and control sciences.

The University is located in the heart of the Minneapolis-St. Paul metropolitan area with over 40,000 full-time students, and all graduate work is administered through the Graduate School. The department is unique in that it is a combination of the traditional civil and mineral engineering disciplines, and the St. Anthony Falls Hydraulic Laboratory and the Mineral Resources Research Center are part of the Department's responsibility. Tuition and fees for full-time graduate students average $750 for residents and $1,640 for nonresidents. Graduate students holding appointments as teaching assistants, research assistants, teaching associates, and administrative fellows at 25 percent time or more pay resident tuition rates.

Admission Requirements

(a) 2.8/4 for MSCE; 2.5/4 usually required for MCE; outstanding students admitted for PhD.

(b) GRE is not required.

(c) GPA requirements for admission are not rigid and may be waived pending other qualifications and recommendations.

(d) TOEFL test is required of all foreign students before admission.

(e) Engineering undergraduate work is desirable but applicants with degrees in allied fields such as chemistry may be admitted.

(f) Nonengineers majoring in environmental engineering are required to have a minimum math background and usually must take fluid mechanics and undergraduate environmental engineering courses without graduate credit.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MSCE	27Q	Yes	No	3Q	9-12
MSCE	45Q	No	No	3Q	9-12
MCE	27Q	Des. Proj.	No	3Q	9-12
PhD	-	-	No	3Q	48

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 5-500	Analysis & Design--Water	Christensen	4Q	W'73	55
CE 5-501	Analysis & Design--Wastewater	Johnson	4Q	S'73	50
CE 5-505	Management of Aquatic Environment	Christensen	4Q	F'73	25
CE 5-510	Solid Waste Management	Johnson	4Q	W'73	40
CE 8-500	Design Water Systems	Johnson	5Q	W'73	12
CE 8-501	Water & Wastewater Chemistry	Johnson	4Q	F'73	12
CE 8-505	Design Wastewater Systems	Maier	5Q	S'73	12
CE 8-507	Industrial Wastes	Maier	3Q	S'73	10
CE 8-510	Sanitary Engineering Unit Operations	Johnson	5Q	Su'72	10
CE 8-515	Unit Processes I	Christensen	3Q	F'73	-
CE 8-516	Unit Processes II	Maier	3Q	W'73	-
CE 8-550	Modeling of Aquatic Environment	Maier & others	4Q	W'73	20

Faculty

WALTER K. JOHNSON
Professor
Department of Civil and Mineral Engineering
1955

BSCE	University of Minnesota	Civil Engineering	1948
MSCE	University of Minnesota	Civil Engineering	1952
PhD	University of Minnesota	Civil Engineering	1963

Water supply and treatment, wastewater collection and treatment, biological waste treatment, nitrification and denitrification

100% (50% teaching, 30% research, 20% administration)

"Process Kinetics for Denitrification," Journal Environmental Engineering Division, American Society of Civil Engineers, SA4, August 1972

"Automated Variable Flow for Pilot Plants," Environmental Science and Technology, 4, 1, January 1970

"Nitrification and Denitrification of Wastewater," NTIS, US Department of Commerce Report PB202350, (with G. B. Vania)

"Carbon Slurry Activated Sludge," Zimpro, Inc., 1973, principal investigator

"Activated Sludge Bulking," Metro Sewer Board, 1973, principal investigator

"Sludge Conditioning Studies," Metro Sewer Board, 1973, co-principal investigator

Registered professional engineer: Minnesota

Previous full-time professional experience: 6 yrs. (1 1/2 yrs. industry and 4 1/2 yrs. consulting)

Member, AEEP
Diplomate, AAEE
President, Northwestern Section, American Society of Civil Engineers (1972-73)
Member, Engineers' Council for Professional Development, Visitation Team

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WALTER J. MAIER
Associate Professor
Department of Civil and Mineral Engineering
1966

BS	R. P. T.	Chemical Engineering	1953
MS	Cornell University	Civil Engineering	1965
PhD	Cornell University	Civil Engineering (Sanitary)	1966

Kinetics of biological wastewater treatment, modeling aquatic environment, surface effects in water treatment-filtration, trace contaminants in water

100% (60% teaching, 20% research, 20% administration)

"Model Study of Colloid Removal," Journal Water Pollution Control Federation, March 1968

"Analysis of Trace Organics in Natural Waters," Office of Water Resources Research

Previous full-time professional experience: 11 yrs. (industry)

GEORGE LEE CHRISTENSEN
Assistant Professor
Department of Civil and Mineral Engineering
1970

BS	Villanova University	Civil Engineering	1960
MS	The Johns Hopkins University	Sanitary Engineering	1968
PhD	The Johns Hopkins University	Sanitary Engineering	1973

Microbiology and biochemistry of wastewater treatment, physical-chemical processes of wastewater treatment

100% (60% teaching, 20% research, 20% administration)

"Ozonation for Wastewater Disinfection," Metro Sewer Board of the Twin Cities, 6/72-6/73, co-principal investigator

Previous full-time professional experience: 3 yrs. (government)

Students

		69-70	70-71	71-72	72-73	73-74	
		FT PT	FT PT	FT PT	FT PT	FT PT	
Environmental Engineering	Master's	5	8	14	16	10	ENROLLMENT
	Doctoral	5	4	2	4	4	
Environmental Engineering	Master's	0	7	2	7	8	GRADUATES
	Doctoral	0	1	1	0	1	
Environmental Engineering	Master's	1	NON-US NATIONALS				
	Doctoral	2					

	Master's	Doctoral	
EPA traineeship	6	0	SUPPORT
Research assistantship	3	1	
Teaching assistantship	2	1	
Self-supported	4	2	
Industrial fellowship	1	0	
Consulting	42	0	EMPLOYMENT (%)
R & D	4	0	
Industry	8	0	
Federal government	13	0	
State government	8	0	
Academic	0	50	
Further study	8	0	
International group	4	50	
County or metro government	13	0	

Mississippi State University

Mississippi State, Mississippi

Department of Civil Engineering
Graduate School

Sanitary Engineering

ECPD Accredited--Undergraduate Program

Prof. Howard K. Williford, Associate Head
Department of Civil Engineering
Drawer HW
Mississippi State, MS 39762
(601) 325-4434

April 1973

The orientation of the graduate program in sanitary engineering at Mississippi State University is for the most part toward water resources and water pollution control, although some effort is devoted to air pollution control and solid waste handling and disposal. Specialization at the Master's level is limited to that extent allowed by thesis research and writing. Areas of special interest include water resources, biological waste treatment, air pollution control, and solid waste handling and disposal. Specialization at the doctoral level is possible to a greater degree but would usually fall in the four general areas mentioned above. The program is design or application oriented with heavy emphasis on unit processes and operations. The departmental objective is to provide a well balanced program combining in proper proportion the fundamentals of theory and practice.

Mississippi State is the land-grant university in Mississippi with the College of Engineering only one of the seven major academic divisions. Current University enrollment is in excess of 9,000 including about 1500 graduate students. Engineering enrollment in the Fall of 1972 was 1,260 undergraduates and graduates. The Mississippi Water Resources Research Institute is one of several federally supported research facilities located on the campus. Also associated with the University is the Gulf Coast Research Laboratory and the Mississippi Sea Grant Consortium, both located at Ocean Springs, Mississippi. Marine related research activities are pursued at these locations. Tuition and fees for full-time residents are $507 per academic year. Fees during the summer are $17.50 per credit hour. A tuition fee of $300 per semester is charged out-of-state regular students.

Mississippi State University is located near Starkville, Mississippi, in the northeastern part of the state. Starkville and vicinity is a progressive community of some 25,000. Students failing to find suitable housing on campus are usually able to do so without difficulty in Starkville. The area is served by three major highways, US Highways 82 and 45 and Mississippi 12. Commercial airline service is available through the Golden Triangle Regional Airport near Columbus, Mississippi.

Admission Requirements

(a) 2.5/4 for the junior and senior years of Bachelor's program.

(b) A minimum composite score of 800 on the Aptitude Test of GRE is required.

(c) Provision admission is possible.

(d) Foreign students must obtain a minimum score of 500 on TOEFL.

(e) Graduates from accredited four-year BS degree programs in civil engineering are fully acceptable. Graduates from similar programs in chemical or biological engineering are acceptable with a minimum number of undergraduate civil engineering remedial courses. Graduates of other engineering disciplines are acceptable upon completion of selected undergraduate remedial courses.

(f) Nonengineering graduates must complete approximately one semester of noncredit undergraduate civil engineering courses including mathematics through differential equations, introductory hydraulics, water supply and pollution control, sanitary analysis, and engineering analysis.

(g) Applicants for admission to the Graduate School must have three letters of recommendation submitted by former professors.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	30S[a]	Yes	No	1S	12
PhD	68S[b]	Yes	2	2S	36

[a] Includes 6S research and writing.

[b] Includes 20S minimum research and writing.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 6523	Open Channel Hydraulics	Zitta	3S	Su'71	17
CE 6833	Sanitary Engineering Comprehensive	Williford	3S	S'73	17
CE 6843	Advanced Sanitary Analysis	Alley	3S	F'72	4
CE 8533	Waterways	Densen	3S	S'70	5
CE 8804	Unit Proc. & Oper. in San. Engr. I	Shindala	4S	F'72	8
CE 8811	Environmental Engineering Seminar	Mahlock	1S	F'72	9
CE 8824	Unit Proc. & Oper. in San. Engr. II	McGriff	4S	S'73	8
CE 8903	Solid Waste Disposal Systems	Mahlock	3S	S'73	21
CE 8923	Stream & Estuarine Analysis	Shindala	3S	S'73	9
CE 8933	Treatment & Disposal of Indus. Wastes	Mahlock	3S	S'72	12
CE 8943	Systems Analysis	Griffis	3S	S'73	16
CE 9823	Water Resources I	Zitta	3S	S'72	6
CE 9843	Design of Sanitary Systems	McGriff	3S	Su'72	4
CE 9853	Intro. to Air Pollution Control	McGriff	3S	F'72	6
MIC 4843	Microbiology for Sanitary Engineers	Mahlock	3S	F'72	10

CE 6843, 8804, 8811, 8824, and 9843 are required of all sanitary engineering majors.

Faculty

HOWARD K. WILLIFORD
Professor of Sanitary Engineering and
Associate Head, Department of Civil Engineering
1947

BS	Millsaps College	Liberal Arts	1932
BS	Mississippi State University	Civil Engineering	1947
MS	Harvard University	Sanitary Engineering	1949

Water resources, water and wastewater treatment

100% (50% teaching, 50% administration)

Registered professional engineer: Mississippi

Member, AEEP
Member, National Society of Professional Engineers
Member, Mississippi Engineering Society
Member, American Water Works Association
Member, Water Pollution Control Federation

JEROME L. MAHLOCH
Assistant Professor
Civil Engineering/Microbiology
1971

PhD	University of Kansas	Environmental Health Engineering	1971

Water quality data analysis, microbiology, solid waste management, modeling, industrial waste treatment

100% (50% teaching, 50% research)

"The Effect of Organic Ammendments from Garbage Grinding on a Biological Treatment System," Completion Report to Office of Water Resources Research, June 1972

"Fungi Present during the Aerobic Decomposition of Selected Solid-Waste Substrates," Developments in Industrial Microbiology, 13, pp. 308-315, 1972

"Mathematical Modeling of the Pascagoula River Basin," Pat Harrison Waterway District, 1/1/72-5/31/73, co-principal investigator

"Statistical Interpretation of Ecological Baseline Data," University Marine Center, 1/1/73-12/31/73, principal investigator

Member, Mississippi Water Pollution Control Association; Vice-President (4/20/73-4/1/74)

VICTOR LAWRENCE ZITTA
Assistant Professor of Civil Engineering
Hydraulics and Hydrology
1970

BS	Virginia Polytechnic Institute	Agricultural Engineering	1961
MS	Iowa State University	Agricultural Engineering	1964
PhD	Virginia Polytechnic Institute	Civil Engineering	1970

Hydraulics and hydrology of natural streams and estuaries, mathematical modeling for water quality management

100% (50% teaching, 50% research)

"Mathematical Modeling for Water Quality Management in the Pascagoula Drainage Basin," Pat Harrison Waterway District, 12/72-date, co-principal investigator

Registered professional engineer: Virginia

Previous full-time professional experience: 1 yr. (academic)

ADNAN SHINDALA
Professor of Sanitary Engineering
Civil Engineering
1967

BS	University of Baghdad	Civil Engineering	1958
MS	Virginia Polytechnic Institute	Sanitary Engineering	1962
PhD	Virginia Polytechnic Institute	Sanitary Engineering	1964

Mathematical modeling in water quality management, biological waste treatment, physicochemical processes, industrial waste treatment

100% (50% teaching, 50% research)

"Mixed Culture Interactions," Journal of Bacteriology, 89, 3, p. 693, 1965 (et al.)

"A Quantitative Comparison of Chlorophyll 'A' with Algal Count and Classification in Oxidation Ponds," Journal Water Pollution Control Federation, 42, 7, p. 1362, July 1970 (with J. V. Dust)

"Chemical-Biological Treatment of Creosote Wastes," Proceedings, 26th Purdue Industrial Waste Conference, May 1971 (et al.)

"Elevation of Three Municipal Waste Stabilization Ponds in Series," Proceedings, 27th Purdue Industrial Waste Conference, May 1972 (with J. L. Mahloch and T. C. Walker)

"Evaluation of Current Techniques of Nutrient Removal from Wastewaters," Water Resources Bulletin, 8, 5, October 1972

"Mathematical Modeling for Water Quality Management in the Pascagoula River Basin," Pat Harrison Waterway District, 1/72-5/73, co-investigator

"Evaluation of Performance of Three Oxidation Ponds in Series," Mississippi Air and Water Pollution Control Association, 1/70-8/71, principal investigator

"Evaluation of Current Techniques for Nutrient Removal from Wastewaters," Water Resources Research Institute, 7/70-6/71, principal investigator

Registered professional engineer: Mississippi

Previous full-time professional experience: 5 yrs. (3 yrs. academic and 2 yrs. government)

Member, AEEP
Member, Water Pollution Control Federation; Member, Research Committee (1972-73)
Chairman, Association of Environmental Engineering Professors, Seminar Committee (1972-73); Member, Newsletter Committee (1972-74)
Consultant, Wyoming Engineering Society (1972-date)

MARVIN T. BOND
Associate Professor
Civil Engineering
1973

BS	Louisiana Polytechnic Institute	Civil Engineering	1957
MS	Louisiana Polytechnic Institute	Civil Engineering	1961
PhD	Tulane University	Civil Engineering	1969

Physical-chemical processes of water treatment, physical-chemical-biological processes of wastewater treatment, industrial waste, solid wastes

100% (75% teaching, 25% research)

"City Fights Color/Turbidity," Water and Wastes Engineering, 8, 10, 1971 (with D. R. Rowe)

"Incineration," Faculty Research Bulletin, Western Kentucky University, 1971 (with D. R. Rowe)

"The Disposal of Spent Coffee Grounds of the Soluble Coffee Industry," Proceedings, 24th Annual Purdue Industrial Waste Conference, Part 1, May 1969 (with L. W. Canter)

"Industrial Waste Treatment," Lenk Manufacturing Company, 7/70-6/80, principal investigator

"Food Service Training Course," Kentucky State Department of Health, 2/70-4/71, project director

"Technical Seminars on Waste Disposal Methods," Kentucky Department of Commerce, 1/69-10/69, director

Registered professional engineer: Louisiana

Previous full-time professional experience: 14 yrs. (10 yrs. academic, 3 yrs. government, and 1 yr. industry)

Member, American Water Works Association; Member, Education and Training Committee, Kentucky-Tennessee Section (1971-date)
Chairman, Education Committee, Kentucky Association of Milk, Food and Environmental Sanitarians (1971-73)
Consultant, Daniel and Tippett, Consulting Engineering (1969-70)

E. CORBIN MCGRIFF, JR.
Assistant Professor
Civil Engineering
1970

PhD	University of Kansas	Environmental Health Engineering	1970

Unit operations and processes, air pollution control and management, biological processes

100% (50% teaching, 50% research)

"The Removal of Nutrient and Organics by Activated Algae," Water Research, 6, pp. 1155-1164, 1972

"Organic Loading Response of the Extended Aeration Activated Sludge Process," Public Works, December 1971

"The Effect of Urbanization of Water Quality," Journal of Environmental Quality, 1, January-March

"Oxygen Uptake Studies on Biological Film Supported by Granular Carbon," Water Research Institute, 7/1/72-6/30/73, principal investigator

Registered professional engineer: Mississippi and Louisiana

Previous full-time professional experience: 2 yrs. (academic)

Member, AEEP
Member, Water Pollution Control Federation; Member, Research Committee
Member, American Society of Civil Engineers
Member, National Society of Professional Engineers

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Sanitary Engineering	Master's	8	18	5	1	7	25	11	15	5	35	ENROLLMENT
	Doctoral	0	1	0	1	1	1	1	0	0	0	
Sanitary Engineering	Master's	8		5		4		4		13		GRADUATES
	Doctoral	0		0		1		0		0		
Sanitary Engineering	Master's	2		NON-US NATIONALS								
	Doctoral	0										

SUPPORT

	Master's	Doctoral
EPA traineeship	5	0
Teaching assistantships	1	0
Other university support	1	0
Government employer	19	0
Self-supported	14	0

Facilities

Mississippi State University has quite adequate laboratory space devoted to graduate teaching and research in the area of sanitary engineering together with the usual array of instrumentation facilities to deal with most problems encountered in pollution abatement efforts. Close association with the US Corps of Engineers Waterways Experiment Station at Vicksburg, Mississippi, makes possible considerable support for research and access to sophisticated facilities not found on the campus.

University of Missouri-Rolla

Rolla, Missouri

Department of Civil Engineering
School of Engineering

Environmental and Sanitary Engineering

ECPD Accredited--Civil Engineering

Dr. Sotirios G. Grigoropoulos
Professor of Civil Engineering
University of Missouri-Rolla
Rolla, MO 65401
(314) 341-4461

February 1974

The environmental and sanitary engineering program which is administered by the Department of Civil Engineering is open to qualified students in engineering and related physical and life sciences. It offers a strong and well-rounded curriculum consisting of graduate training and research in the areas of water and wastewater engineering, air pollution control, and solid waste management and leads to the MS and PhD degrees in civil engineering. The program is well supported with departmental offerings in other areas, primarily water resources engineering, hydrology and hydraulic engineering, environmental and planning engineering, complemented with courses in other engineering and science disciplines and strengthened by a strong and expanding research program.

The University of Missouri-Rolla is one of the four campuses of the University of Missouri, with other campuses located in Columbia, Kansas City, and St. Louis. Founded in 1870 as the University of Missouri School of Mines and Metallurgy, the University of Missouri-Rolla specializes in engineering and applied science and enrolls one of the nation's largest engineering student bodies. The University also offers a small but quality liberal arts degree program and enrolls a growing number of students in social and humanistic studies. Known for many decades for its strong undergraduate program, the University of Missouri-Rolla has placed special emphasis in graduate education and research while sustaining its undergraduate effort. Civil Engineering Department is the largest department on the campus and for several years has had the largest undergraduate enrollment in the nation (in the fall of 1973 543 undergraduates and 66 graduate students were enrolled in the department). The Department has a faculty of 32 members of which eight are directly associated with the training and research program in environmental and sanitary engineering. Fees for full-time graduate students total $729 (residents) and $1,250 (nonresidents) for the calendar year.

Rolla, a growing community of 13,250, is located in southcentral Missouri at the end of the Ozarks region approximately 100 miles southwest of St. Louis. Also located in Rolla are the Missouri Geological Survey and Water Resources, regional offices of the US Geological Survey, the Rolla Metallurgy Research Center of the US Bureau of Mines, and the headquarters of the Clark National Forest.

Beginning with the fall 1971 semester, an evening program leading to the MS with specialization in environmental and sanitary engineering has been offered at the University of Missouri-Rolla Graduate Engineering Center in St. Louis. Fees are $55 per credit hour.

Admission Requirements

(a) Students ranked in the upper one-third of their baccalaureate graduating class or who have done quality work at the graduate level; alternately, a 3.0/4 GPA in junior and senior years.

(b) GRE (both the aptitude and advanced sections) is a precondition for admission. Students unable to take the examination before enrolling should take it at the first available opportunity as a condition for completion of admission requirements.

(c) Admission as a special graduate student may be granted to those students who ranked in the upper three-fourths of their baccalaureate graduating class and present strong evidence of ability to do graduate work. These students must complete a minimum of 12 semester hours of graduate course work with a cumulative GPA of 3.0/4 or higher to obtain regular graduate student status.

(d) Foreign students must score a minimum of 500 on TOEFL.

(e) Any engineering discipline from an ECPD-accredited institution is normally accepted. Students with undergraduate degrees in physical and life sciences may also be accepted.

(f) Students with undergraduate training in a discipline other than civil engineering are encouraged to take deficiency undergraduate work in water and wastewater engineering.

(g) Letters of recommendation from former professors or supervisors in professional work are desirable at the MS level and required at the PhD level.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	[a]	Optional	No	[b]	12-18
PhD--Civil Engineering	72-96S[c]	Yes	1	[d]	36-42

[a] If the nonthesis option is selected, 33S are required and with thesis option 30S are required (including 6S of thesis research credit). A minimum of 6S must be taken outside the Civil Engineering Department.

[b] A maximum of 9S may be transferred from other universities.

[c] Includes 35-40S of dissertation research credit.

[d] 2 consecutive semesters.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 362	Public Health Engineering	Jennette Modesitt Clark Purushothaman	3S	S'74	20
CE 363	Solid Waste Management	Clark	3S	F'73	23
CE 364	Solid Waste Laboratory	Clark	1S	on demand	-
CE 365	Sanitary Engineering Analysis	Huang Purushothaman Modesitt	3S	S'74	10

CE 367	Air Pollution Abatement I	Purushothaman Huang	3S	F'73	33
CE 368	Air Pollution Abatement II	Purushothaman	3S	S'74	10
CE 369	Sanitary Engineering Design	Grigoropoulos	3S	S'74	14
CE 461	Sanitary Microbiology	Modesitt Wixson	3S	F'73	15
CE 462	Water Treatment	Grigoropoulos	3S	F'73	16
CE 463	Wastewater Treatment I	Grigoropoulos Huang	3S	S'74	14
CE 464	Wastewater Treatment II	Jennett Huang	3S	S'74	14
CE 469	Adv. Sanitary Engineering Design	Grigoropoulos	3S	S'73	3
EnE 465	Water Resources & Waste Management	Grigoropoulos Jennett	3S	S'73	6
CE 480	Water Resources Engineering I	Staff	3S	F'73	5
CE 309	City Planning	Sieck Green	2S	F'73	18
CE 338	Hydrologic Techniques	Stevens	3S	F'72	10
CE 380	Water Resources & Engineering	Staff	3S	F'74	11
CE 431	Adv. Hydraulics & Hydraulic Engr.	Gevecker	3S	F'72	11
EnE 351	Urban & Regional Planning & Design	Green Sieck	3S	F'73	12
Chem 355	Instr. Methods of Chemical Analysis	Webb	3S	S'72	13
Chem 361	General Biochemistry	Siehr	3S	F'73	21
Geol 413	Clay Minerology	Bolter	3S	F'73	6
CSc 218	Introduction to Numerical Methods	Staff	3S	S'74	98
CSc 364	Prob. Operations Research Survey	Staff	3S	S'74	41
Math 215	Engineering Statistics	Staff	3S	S'74	108
Mgt 314	Organ. Theory & Corp. Structure	Staff	3S	S'74	18
Mgt 363	Management's Envir. Responsibilities	Waters	3S	S'74	21
Mgt 386	Safety Engineering Management	Hegler	3S	S'74	37
Mgt 456	Advanced Personnel Management	Staff	3S	S'74	8
CE 362[1]	Public Health Engineering	Jennett Modesitt	3S	S'73	32
CE 363[1]	Solid Waste Management	Clark	3S	F'73	30
CE 367[1]	Air Pollution Abatement I	Purushothaman	3S	S'74	34
CE 369[1]	Sanitary Engineering Design	Grigoropoulos	3S	S'74	28
CE 401[1]	Special Topics--Ind. Waste Treat.	Huang	3S	F'73	17
CE 462[1]	Water Treatment	Grigoropoulos	3S	S'73	30
CE 463[1]	Wastewater Treatment I	Grigoropoulos	3S	F'72	33
EnE 465[1]	Water Resources & Waste Management	Grigoropoulos	3S	S'72	29

[1] Offered at the UMR Graduate Engineering Center in St. Louis.

CE 365, 369, 461, 462, and 463 are required core courses; also, either or both CE 362 and 464 are taken by most students specializing in water and wastewater engineering.

CE 362, 363, 367, 369, 401, 462, 463, and EnE 465 are recommended core courses for students specializing in environmental and sanitary engineering at the UMR Graduate Engineering Center.

Faculty

SOTIRIOS G. GRIGOROPOULOS
Professor of Civil Engineering and
Head, Environmental and Sanitary Engineering Area
Civil Engineering Department
1960

ChemE	National Technical University at Athens	Chemical Engineering	1955
MS	Washington University	Chemical Engineering	1958
ScD	Washington University	Sanitary Engineering	1960

Water and wastewater treatment theory and design, trace substances (organic, metallic, organametallic) in water, removal of nutrients from wastewater, stormwater runoff

100% (65% teaching, 20% research, 15% administration)

"Thickening and Dewatering Characteristics of Activated Sludge Containing Metal-Precipitated Phosphorus," Transactions, 23rd Annual Sanitary Engineering Conference, The University of Kansas, 29, 1973 (with L. W. Maritt)

"Fate of Aluminum-Precipitated Phosphorus in Activated Sludge and Anaerobic Digestion," Journal Water Pollution Control Federation, 43, p. 2366, 1971 (with R. C. Vedder and D. W. Max)

"Trace Organics in Subsurface Waters," in Organic Compounds in Aquatic Environments, Marcel Dekker, Inc., New York, p. 95, 1971 (with J. W. Smith)

"Wastewater Reclamation by Reverse Osmosis-Treatment of Wastes Produced," Proceedings, 26th Purdue Industrial Waste Conference, May 1971, in press (with J. C. Jennett)

"Toxic Effects of Trace Organics on Fish," Journal American Water Works Association, 62, p. 499, 1970 (with J. W. Smith)

"Professional Training in Water Supply and Pollution Control," US Environmental Protection Agency, 6/66-date, director

"Long-Term Toxic Effects of Odorous Micropollutants," US Public Health Service, 5/65-10/68, principal investigator

"Predoctoral Research Fellowships," doctoral study and research in nutrient removal and trace organic pollutants, US Environmental Protection Agency, 7/69-9/72, director

Registered professional engineer: Missouri

Previous full-time professional experience: 2 1/2 yrs. (1 yr. industry, 1/2 yr. consulting, and 1 yr. research)

Member, American Water Works Association; Member (1968-71), Chairman (1972-date), Committee on Organic Contaminants, Water Quality Division
Member, American Society of Civil Engineers; Member, Control Group (1971-73); Chairman (1972-73), Member (1973-date), Committee on Water Purification, Environmental Engineering Division
Expert reviewer, Student Originated Studies and Instructional Scientific Equipment Programs, National Science Foundation (1972-date)

J. KENT ROBERTS
Professor of Civil Engineering and
Assistant Dean of Engineering
1947

BS	University of Oklahoma	Civil Engineering	1947
MS	Missouri School of Mines & Metallurgy	Civil Engineering	1950

Water and wastewater engineering, engineering economics, professional development and effective teaching

20% (teaching)

"Yosemite Valley Water Systems," US Public Health Service, 1955

"Notes on Water and the Bacteriological Analysis," Civil Engineering Department, University of Missouri-Rolla, 1950, rev. 1961

Registered professional engineer: Missouri

Previous full-time professional experience: 3 yrs. (government)

Member, Missouri Registration Board for Architects and Professional Engineers (1966-date)
Member, National Society of Professional Engineers; Vice President, North Central Region (1973-date); Chairman, Professional Engineers in Education (1968-69); Director (1964-68)
President, Missouri Society of Professional Engineers (1965-66)
President, Missouri Association of Land Surveyors (1963-64)

BOBBY G. WIXSON
Professor of Environmental Health and
Associate Director, Center for International Programs and Studies
1967

BS	Sul Ross State College	Geology	1960
MA	Sul Ross State College	Biology	1961
PhD	Texas A&M University	Aquatic Biology & Oceanography	1967

Aquatic biology and sanitary microbiology, trace metals in the environment, solid waste disposal

55% (10% teaching, 45% research)

"Development of a Cooperative Programme for Environmental Protection between the Lead Mining Industry Government, and the University of Missouri," Proceedings, Minerals and the Environment Symposium, Institute of Mining and Metallurgy, London, 1974

"Aquatic Organisms and Heavy Metals in Missouri's New Lead Belt," Water Resources Bulletin, 9, p. 673, 1973 (et al.)

"Transport Mechanisms of Lead Industry Wastes," Proceedings, 28th Annual Purdue Industrial Waste Conference, May 1973, in press (et al.)

"Use of Domestic Waste Glass as Aggregate in Bituminous Concrete," Highway Research Record No. 307, Highway Research Board, 1970 (with W. R. Malisch and D. E. Day)

"Ecological Effects of Evaporation Retardation Monolayers on Reservoirs," American Geophysical Union, Monograph No. 17, 1973 (with W. J. Clark and W. B. Davis)

"An Interdisciplinary Investigation of Environmental Pollution by Lead, Copper, Zinc, Cadmium and Other Metals in the New Lead Belt of Southeastern Missouri," National Science Foundation (RANN), 6/71-date, director

"Use of Domestic Waste Glass for Urban Paving," US Public Health Service, 6/69-7/72, co-investigator

"Stream Pollution in the Lead Belt of Southeastern Missouri," Office of Water Resources Research, 7/68-6/70, director

Previous full-time professional experience: 2 yrs. (academic)

Member, Committee on Geochemical Environment Related to Health and Disease, National Academy of Science-National Research Council (1972-date)

JU-CHANG HUANG
Associate Professor of Civil Engineering and Environmental Health
1967

BS	National Taiwan University	Civil Engineering	1963
MS	University of Texas-Austin	Environmental Health Engineering	1966
PhD	University of Texas-Austin	Environmental Health Engineering	1967

Biological and physical-chemical waste treatment, sanitary engineering analysis waste treatment systems, pollutant release from aquatic sediment

100% (50% teaching, 50% research)

"Hawaii Gives Leis to New-Tertiary Waste Plant," Water and Waste Engineering, 10, 5, 1973 (with R. L. Smith and T. S. Otaguro)

"Pesticides in Water-Effects on Human Health," Journal of Environmental Health, 34, 501, 1972

"Treatment of Refinery Waste by Physicochemical Processes," Journal Sanitary Engineering Division, American Society of Civil Engineers, 97, p. 467, 1971 (with M. G. Hardie)

"Effect of Selected Factors on Pesticide Sorption and Desorption in the Aquatic System," Journal Water Pollution Control Federation, 43, p. 1739, 1971

"Water Reclamation by Physicochemical Treatment of Waste Water," Water Resources Bulletin, 7, p. 148, 1971 (with M. G. Hardie)

"Pollution Potential of Aquatic Sediments," Office of Water Resources Research, 7/72-6/74, director

"A New Approach for Water Reclamation-Complete Treatment of Wastewater by Physical-Chemical Processes," Office of Water Resources Research, 7/70-6/72, director

"Sorption and Desorption of Chlorinated Hydrocarbon Pesticides in Aquatic Sediment Minerals," Office of Water Resources Research, 7/68-6/71, director

Registered professional engineer: Texas

Previous full-time professional experience: 1 yr. (government)

American Society for Engineering Education/Ford Foundation Resident Fellow (1972-73), served as Assistant to Vice President and Chief Sanitary Engineer, Austin, Smith and Associates, Inc., Honolulu

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J. CHARLES JENNETT
Associate Professor of Civil Engineering
1969

BS	Southern Methodist University	Civil Engineering	1963
MS	Southern Methodist University	Sanitary Engineering	1966
PhD	University of New Mexico	Environmental & Sanitary Engr.	1969

Biological waste treatment, industrial waste treatment, public health engineering, toxic metals in the environment, wastewater reclamation and recycling techniques

100% (40% teaching, 60% research)

"The Viburnum Trend, Southeast Missouri: The Largest Lead-Mining District in the World--Environmental Effects and Controls," Proceedings, Minerals and the Environment Symposium, Institute of Mining and Metallurgy, London, 1974 (et al.)

"Environmental Problems and Solutions Associated with the Development of the World's Largest Lead Mining District," Pollution Engineering and Scientific Solutions, Plenum Press, New York, p. 320, 1973 (et al.)

"Problems of Lead Mining Waste Control," Journal Water Pollution Control Federation, 44, p. 2103, 1972 (with B. G. Wixson)

"A Report on the Treatability of Reverse Osmosis Raffinates by Activated Sludge," Journal Water Pollution Control Federation, 43, p. 381, 1971 (with C. C. Patterson)

"Environmental Effects of Open-Drained Sludge Drying Beds," Journal Water Pollution Control Federation, 45, p. 449, 1973 (with D. J. Harris)

"An Interdisciplinary Investigation of Environmental Pollution by Lead, Copper, Zinc, Cadmium and Other Metals in the New Lead Belt of Southeastern Missouri," National Science Foundation (RANN), 6/71-date, co-director

"Cooperative Air Quality Research to Protect the Forests in the New Lead Belt of Missouri," Missouri Lead Operating Company, 1/71-12/71, director

"Environmental Factors in Sludge Bed Drying," Office of Water Resources Research, 7/70-6/71 director

Registered professional engineer: Missouri

Previous full-time professional experience: 2 1/2 yrs. (industry)

Member, American Society of Civil Engineers; Member, Committee on Water Purification (1973-date); Chairman, Subcommittee on Trace Elements and Toxicity, Environmental Engineering Division (1973-date)
Young Engineer of the Year (1974), Rolla Chapter, Missouri Society of Professional Engineers

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KRISHNIER PURUSHOTHAMAN
Associate Professor of Civil Engineering
1967

BE	University of Madras	Civil Engineering	1956
MSc	University of Madras	Public Health Engineering	1958
PhD	University of Texas-Austin	Environmental Health Engineering	1968

Air quality monitoring and control, sanitary engineering analysis, water pollution control, industrial hygiene

100% (60% teaching, 40% research)

"Development of Air Quality Monitoring System to Control Lead Smelter Episodes," Transactions, 23rd Annual Sanitary Engineering Conference, The University of Kansas, p. 113, 1973 (et al.)

"The Lead Industry as a Source of Trace Metals in the Environment," Proceedings, Environmental Resources Conference on Cycling and Control of Metals, Batelle Memorial Institute, p. 11, 1973 (et al.)

"Environmental Impact of Trace Metals on the New Lead Belt of Southeast Missouri," Transactions American Geophysical Union, 52, p. 827, 1971 (et al.)

"Removal of Phosphorus from Waste Water to Control Eutrophication," Proceedings, University of Missouri's 5th Annual Conference on Trace Substances in Environmental Health, p. 95, 1972 (with C. M. Yue)

"Field Studies on Stabilization Ponds in South India," Proceedings, 2nd International Symposium on Waste Treatment Lagoons, Kansas City, p. 80, 1970

"An Interdisciplinary Investigation of Environmental Pollution by Lead, Copper, Zinc, Cadmium and Other Metals in the New Lead Belt of Southeastern Missouri," National Science Foundation (RANN), 6/71-date, co-investigator

"An In-Depth Study of the Impact of a Lead Smelter Operation on the Local Environment," American Smelting and Refining Company, 6/73-5/74, co-investigator

"Removal of Phosphates by Sorption on Activated Alumina," Office of Water Resources Research, 7/69-6/70

Previous full-time professional experience: 7 yrs. (academic)

Member, National Air Pollution Control Association; Member, Subcommittee on Non-Ferrous Smelting and Refining (1973-date)

Member, Missouri Air Conservation Commission; Member, Lead Regulations Committee (1972-date)

RALPH H. CLARK
Assistant Professor of Civil Engineering
1969

BS	Utah State University	Civil Engineering	1966
MS	Utah State University	Civil Engineering	1967
ScD	New Mexico State University	Sanitary Engineering	1969

Biological waste treatment, solid waste management, teaching methodology

100% (90% teaching, 10% research)

"The pH Tolerance of Anaerobic Digestion," Proceedings, 5th International Conference on Water Pollution Research, Pergamon Press, 1971 (with R. E. Speece)

"Digestion: Concentration-Loading-Time Limits," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, p. 809, 1972 (with V. D. Orr)

"The Abstraction of Civil Engineering Students," Proceedings, American Society of Civil Engineers Conference on Civil Engineering Education, 1974

"In Situ Hypolimnion Reaeration," Office of Water Resources Research, 7/71-6/72, director

Registered professional engineer: Missouri

DONALD E. MODESITT
Assistant Professor of Civil Engineering
1960

BS	Missouri School of Mines & Metallurgy	Civil Engineering	1958
MS	University of Missouri-Rolla	Civil Engineering	1966
PhD	Oklahoma State University	Bioenvironmental Engineering	1970

Sanitary microbiology, biological waste treatment, water quality, public health engineering

100% (65% teaching, 35% research)

"Methods for Evaluating the First Order Constants K_1 and L for BOD Exertion," Center for Water Research in Engineering, Oklahoma State University, Pub. M-1, 1967 (et al.)

"Missouri River Environmental Inventory: Rulo, Nebraska to Mouth near St. Louis, Missouri," Civil Engineering Department, University of Missouri-Rolla, Report to Kansas City District, US Army Corps of Engineers, 1972 (co-author)

"A Base Line Study of the Missouri River: Rulo, Nebraska to the Mouth near St. Louis, Missouri," US Army Corps of Engineers, Kansas City District, 8/72-date, head water quality investigation

Registered professional engineer: Missouri

Previous full-time professional experience: 2 yrs. (government)

ERNST A. BOLTER
Associate Professor of Geochemistry
College of Arts and Sciences
PhD University of Goettingen Geochemistry 1961
Pollution by mines and smelters, geochemistry of trace metals

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NORD L. GALE
Associate Professor of Life Sciences
College of Arts and Sciences
PhD Brigham Young University Bacteriology & Biochemistry 1967
Algal growth problems and trace metals, toxicity studies

DONALD J. SIEHR
Professor of Chemistry
College of Arts and Sciences
PhD University of Wisconsin Biochemistry 1957
General biochemistry, characterization of trace organic contaminants

Students

ENROLLMENT

		69-70		70-71		71-72		72-73		73-74	
		FT	PT	FT	PT	FT	PT*	FT	PT*	FT	PT*
Environmental & Sanitary Engineering	Master's	15	-	21	-	30	20	32	30	19	35
	Doctoral	1	-	2	-	3	-	3	-	4	-

GRADUATES

		69-70	70-71	71-72	72-73	73-74
Environmental & Sanitary Engineering	Master's	4	13	9	17	18
	Doctoral	0	0	0	0	3

NON-US NATIONALS

Environmental & Sanitary Engineering	Master's	4
	Doctoral	3

SUPPORT

	Master's	Doctoral
EPA scholarship and stipend	11	0
USAID fellowship	1	0
Foreign government fellowship	0	1
Graduate research assistantship	6	1
Graduate teaching assistantship	1	2
Chancellor's fellowship	1	0
Government employer	1	0

*At the UMR Graduate Engineering Center in St. Louis.

EMPLOYMENT (%)

	Master's	Doctoral
Consulting	38	33
Industrial	7	0
Federal government	12	0
State and local government	11	0
Academic	3	33
Further study	5	0
Military	13	0
Unknown	3	0
Undecided (1974 graduates)	8	33

Facilities

The sanitary engineering laboratories are located in the Civil Engineering building which was constructed in 1959; four laboratories, sanitary chemistry, sanitary microbiology, research, and instrumentation, occupy a total of 2500 sq ft. Additional research space is shared with the Environmental Research Center in the new (1971) Engineering Research Building; the 4000-sq ft environmental control laboratory incorporates general research, pilot plant, instrumentation, air pollution, and radiological health areas. These facilities are well-equipped with fixed, analytical and testing equipment, five walk-in controlled temperature rooms, and specialized research instrumentation for studies in the environmental and sanitary engineering area.

Major equipment items include: atomic absorption spectrophotometer (Perkin-Elmer 305A), two gas chromatographs (Varian Aerograph 1520-1B and Bendix Chroma-Lab 2100), infrared spectrophotometer (Beckman IR10), fluorescence spectrophotometer (Baird-Atomic Fluorispec), carbonaceous analyzer (Beckman), gas partitioner (Fisher-Hamilton 29), 12-station Kjeldahl digestion and distillation unit (Labconco), 3-station magnetic drive fermentor (VirTis 40-300R), sonifier cell disruptor (Heat Systems-Ultrasonics W-350B), specific ion electrodes (Orion NO_3, F, Cl, Br, NH_3) and expanded scale pH meters (Orion and Corning), differential and Warburg respirometers (Gilson Medical GRP-20 and RWBP3), SO_2 analyzer (Beckman 906A), electrostatic precipitator (MSA 48295), two nonviable samplers (Andersen 21-000 and 23-000), Gill bivane anemometer (R. M. Young), hi-volume particle sizing collector (Andersen 2000).

Montana State University

Bozeman, Montana

Department of Civil Engineering and Engineering Mechanics

College of Engineering

1893

Environmental Engineering

Environmental Health Engineering

Dr. Glen L. Martin, Head
Department of Civil Engineering and Engineering Mechanics
Montana State University
Bozeman, MT 59715
(406) 994-2111

February 1974

The graduate environmental engineering program at Montana State University is oriented towards water quality control. The core program includes sanitary microbiology, chemistry for environmental engineers, water quality chemistry, criteria and management, and unit processes for water and wastewater treatment. Courses in industrial waste treatment, solid wastes, air pollution, and radiological health are offered. Minors, flexible in credits and subject matter, include hydraulics, mathematics, biology, chemistry, business or humanities. The MS and PhD degrees are awarded.

The objectives of the environmental health engineering program are: long-range planning, development of leadership potential, skill in oral and written communication, capability in administration, and direction of community programs. It is a terminal 21-month program which includes a summer's field experience, courses in leadership, planning, public speaking, business administration, in addition to the more common courses in public health engineering and control of air, land, and water quality. At present the degree is MS in civil engineering, but action is underway for a more appropriate degree for this 69 credit hour program (such as Master of Environmental Health Engineering).

Montana State University is a land-grant institution with emphasis on agriculture, science, and engineering located in a fertile valley at an elevation of 4800 feet and closely surrounded by high mountains with excellent skiing, fishing, hiking, hunting, and sightseeing within a few minutes drive. The enrollment is approximately 8000 including about 500 graduate students of which about 100 are in the College of Engineering. In the number of graduate students, the Department of Civil Engineering ranks first in the College of Engineering and fifth among all university departments.

Resident graduate students pay about $144 per quarter and nonresident about $427 in fees.

Admission Requirements

(a) 3.0/4 for last two years or 3.0/4 cumulative.

(b) No minimum score on GRE is required for admission.

(c) Provisional admission is possible if, in the mind of the Graduate Dean, the student is likely to be successful.

(d) A TOEFL score of 500 minimum is required of foreign students.

(e) Any engineering discipline is acceptable as well as biology, chemistry, mathematics, and physics.

(f) Prerequisites depend on the student's background; however, typical requirements include: mathematics through calculus and differential equations, mechanics (statics and dynamics), fluid mechanics, and some upper division professional courses (e.g. hydraulic structures).

(g) Foreign students must have $3,000/year guaranteed plus transportation to United States and home.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	[a]	Optional	No	3Q	12
MS--Civil Engineering[b]	69Q[c]	No	No	3Q	21
PhD--Civil Engineering	85Q[c]	Yes	1[d]	6Q	42

[a] If thesis option is chosen, 30Q; nonthesis option, 45Q.

[b] Action is being taken to obtain Master of Environmental Health Engineering.

[c] Typical, may be more or less.

[d] Substitution is permissible.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 540	Water Quality	Asano	-	A'72	7
CE 541	Water Treatment	Sanks	-	W'73	7
CE 542	Wastewater Treatment	Asano	-	S'73	10
CE 443	Air Pollution Control & Solid Waste Management	Asano Van't Hul	-	S'73	7
CE 543	Industrial Water & Wastes	Sanks	-	S'71	8
CE 544	Environmental Engineering Lab I	Sanks	-	W'73	3
CE 545	Environmental Engineering Lab II	Asano	-	S'73	7
CE 546	Radiological Health Engineering	Sanks	-	NEW'69	-
CE 547	Chemical Applications to Envir. Engr. I	Sanks	-	A'72	5
CE 548	Chemical Applications to Envir. Engr. II	Asano	-	W'73	5
CE 533	Advanced Hydrology	-	-	-	-

CE 538[1]	Water Resources Systems Planning	-	-	-	-
CE 580[1]	Water and Waste Analysis	Staff	-	NEW'73	-
CE 580[1]	Water Supply Planning	Staff	-	NEW'73	-
CE 580[1]	Liquid Waste Treatment & Control	Staff	-	NEW'73	-
CE 580[1]	Community Facilities Planning	Staff	-	NEW'73	-
CE 570[1]	Summer Field Problem	Staff	-	NEW'73	-
MB 201	Microbiological Techniques	Nelson	-	S'72	70
MB 408	Environmental Microbiology	Jezeski		W'73	16
MB 580	Microbial Reaction to Environment	Temple	-	-	-
MB 500	Microbiology Seminar (for Envir. Engr.)	Temple	-	-	-
Geol 440	Ground Water	Brustkern	-	W'72	20
Bot 545	Principles of Aquatic Ecology (Chemical Limnology)	Wright	-	A'72	-

[1] Environmental health engineering only.

CE 540, 541, 542, 544, 545, 547, 548, MB 201, 408, and 500 are generally required, however, there may be exceptions.

Faculty

ROBERT L. SANKS
Professor
Department of Civil Engineering and Engineering Mechanics
1966

BS	University of California-Berkeley	Civil Engineering	1940
MS	Iowa State College	Civil Engineering	1949
PhD	University of California-Berkeley	Sanitary Engineering	1965

Water quality, advanced waste treatment, ion exchange, sorption, recycling wastewaters

100% (40% teaching, 30% research, 30% administration)

Ion Exchange Color and Mineral Removal from Kraft Bleach Wastes, US Environmental Protection Agency, Project No. 12040 DBD (in press)

"Improving the Efficiency of Cation Exchange," Proceedings, American Power Conference, 29, 1967

"Recycling of Saline Wastes," Proceedings, 3rd International Conference on Water Pollution Research, Munich, 1966 (with W. J. Kaufman)

"Color and Mineral Removal from Kraft Bleach Wastes," US Environmental Protection Agency, 4/1/69-5/1/73, principal investigator

"Acid Mine Waste Pollution Abatement," Montana Board of Health, 6/6/69-1/31/71, principal investigator

"Liquid and Solid Waste Disposal in US Forest Lands," US Forest Service, 6/1/73-12/31/74, principal investigator

Registered professional engineer: Montana and California

Previous full-time professional experience: 21 yrs. (15 yrs. academic, 3 yrs. research, 2/3 yr. government, 2 1/3 yr. industry)

Member, AEEP
Member, American Society of Civil Engineers; Past President, Intermountain Section
Member, American Water Works Association; Member, Committee on Water Desalting
Member, Montana Water Pollution Control Association
Associate Member, American Chemical Society
Member, American Association for the Advancement of Science

TAKASHI ASANO
Adjunct Assistant Professor
Department of Civil Engineering and Engineering Mechanics
1971

BS	Hokkaido University, Japan	Agricultural Chemistry	1959
MSE	University of California-Berkeley	Sanitary Engineering	1965
PhD	The University of Michigan	Sanitary Engineering	1970

Water quality, eutrophication, advanced waste treatment

100% (50% teaching, 50% research)

"Centrifugal Dewatering of Municipal and Industrial Sludge," Water and Sewage Works (in press)

"Leaching of Pollutants from Wood Chips Transported in Simulated Hydraulic Pipelines," submitted to US Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah, October 1972 (with W. A. Hunt and R. L. Sanks)

"Investigation of Drainage Disposal to San Francisco Bay," Hydraulic Model Studies to Determine Waste Dispersive Characteristics of Suisun and San Pablo Bays, California Department of Water Resources, Sacramento, March 1968

"Investigation of Drainage Disposal to San Francisco Bay," Prototype Studies to Determine Waste Dispersive Characteristics of Lower Delta and Suisun Bay, California Department of Water Resources, Sacramento, February 1968

"Distribution of Pollutional Loadings in Suisun Bay," Proceedings, National Symposium on Estuarine Pollution, Stanford University, Stanford, California, August 1967

"Leaching of Pollutants from Wood Chips Transported in Simulated Hydraulic Pipelines," US Department of Agriculture, Forest Service, 7/1/71-6/30/72, principal investigator

"Feasibility of Treating Wood-Chip Carrier Water," US Department of Agriculture, Forest Service, 7/1/72-6/30/73, principal investigator

Registered professional engineer: California and Michigan

Previous full-time professional experience: 8 yrs. (5 yrs. consulting and 3 yrs. research)

Member, AEEP
Member, American Society of Civil Engineers
Member, American Water Works Association
Member, Water Pollution Control Federation (California Association)

THEODORE T. WILLIAMS
Professor
Department of Civil Engineering and Engineering Mechanics
1956

BS	Colorado State University	Civil Engineering	1949
MS	Colorado State University	Irrigation Engineering	1956

Development of state reservoir operations model, water resources engineering, water resources management and planning, engineering hydrology, development of state water-planning model

100% (30% teaching, 30% research, 40% administration)

"Development of a State Water-Planning Model," (published in five parts plus a final report), Montana University Joint Water Resources Research Center, Montana State University, Reports No. 15, 26, 32, 34, 35, and 36, 1971, 1972, 1973, 1973, 1973, 1973 (with D. W. Boyd and R. L. Brustkern)

"Hydrologic Analysis of Small Watersheds in Montana," American Society of Civil Engineers, Meeting Preprint 1827, 1972

"Water Resources in Sourdough and Hyalite Creeks--A Comparative Study of Quality and Hydrology," Montana University Joint Water Resources Research Center, Montana State University, 1972 (with R. L. Sanks)

"Development of a State Reservoir Operations Model," Office of Water Resources Research and Montana State Department of Natural Resources and Conservation, 7/72-6/74, principal investigator

"Development of a State Water-Planning Model," Office of Water Resources Research and Montana State Department of Natural Resources and Conservation, 7/68-9/72, co-principal investigator

"Drainage Correlation Research Project," Montana State Highway Commission, 7/63-6/71, principal investigator

Registered professional engineer: Montana

Previous full-time professional experience: 4 1/2 yrs. (industry)

Member, American Society of Civil Engineers (1949-73)
Member, American Society for Engineering Education (1959-73)
Member, Sigma Xi (1957-73)

JAMES J. JEZESKI
Professor
Department of Microbiology

PhD	University of Minnesota	Bacteriology and Immunology	1947

General microbiology, food and dairy microbiology, sanitation and environmental microbiology, environmental health, water quality, public health and foods
10%

KENNETH L. TEMPLE
Professor
Department of Microbiology

PhD	Rutgers University	Microbiology and Biochemistry	1948

Soil microbiology, environmental microbiology
5%

JOHN C. WRIGHT
Professor
Department of Biology

PhD	Ohio State University	Zoology	1950

Limnology and ecology
20%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	5	0	8	0	4	0	7	0	14	0	ENROLLMENT*
	Doctoral	0	0	0	0	0	0	1	0	1	0	

		69-70	70-71	71-72	72-73	73-74	
Environmental Engineering	Master's	2	2	7	4	1	GRADUATES
	Doctoral	0	0	0	0	0	

Environmental Engineering	Master's	1	NON-US NATIONALS
	Doctoral	0	

	Master's	Doctoral	
EPA traineeship	4	0	SUPPORT
EPA doctoral fellowship	0	1	
Industrial fellowship	1	0	

*Environmental health engineering program began September 1973.

EMPLOYMENT (%)

	Master's	Doctoral
Consulting	31	-
Industry	8	-
Federal government	23	-
Other government	15	-
Further graduate study	15	-
Military	8	-

Facilities

Montana State University has unusually complete 1/2 gpm pilot plants for nearly all usual processes used to treat water and wastewater with complete, new, and modern analytical instruments for rapid determination of quality changes caused by treatment. A mobile laboratory, 12x35 feet containing an office, 50 feet of chemical benches, and a pilot plant room is used for on-site studies. Currently located at the Bozeman Sewage Treatment Plant, it is equipped with water, electricity, air conditioning, sewer, and hard-plumbed sampling lines to raw sewage, primary clarifiers, aeration basin, and secondary clarifiers.

University of Nebraska

Lincoln, Nebraska

Department of Civil Engineering
College of Engineering and Technology

Sanitary Engineering (Civil)

ECPD Accredited

Dr. Edward N. Wilson, Chairman
Department of Civil Engineering
129 Bancroft
University of Nebraska
Lincoln, NB 68508
(402) 472-2371

February 1974

The program in sanitary engineering is directed toward problems of water quality and pollution control with emphasis in the areas of wastewater processing and municipal water supply. Courses in the applications of chemistry and biology are used as a basis for process design courses in water and wastewater treatment. Water resources, hydraulics, and hydrology are also available within the Civil Engineering Department. A typical Master's program includes these plus air pollution offered by the Chemical Engineering Department and limnology in the Department of Zoology.

For those students interested in a stronger science-oriented program, working arrangements are available with microbiology, chemistry, and zoology. Interdisciplinary courses are offered with the College of Law and Agricultural Engineering.

Admission Requirements

(a) 2.5/4 for MS and 3.0/4 for PhD.

(b) GRE is not required for graduates of accredited engineering programs in the United States.

(c) Provisional admission is possible for students without adequate undergraduate preparation.

(d) Foreign students must score at least 450 on TOEFL examination.

(e) Any engineering discipline is acceptable.

(f) Nonengineers must make up the following prerequisites: mathematics, undergraduate sanitary engineering courses, fluid mechanics, and hydrology.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Sanitary Engineering	[a]	Optional	No	-	[b]
PhD--Sanitary Engineering	-	Yes	No	-	36[c]

[a] 30S for thesis option (including 6S thesis) and 36S for nonthesis option.

[b] Thesis option--12 months; nonthesis option--3S.

[c] Beyond Master's degree.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 815	Water Resources Development	Lewis	3S	72-73	8
CE 822	Hydrology	Marlette	3S	72-73	12
CE 838	Applications of Chemistry	McGhee	3S	72-73	11
CE 829	Applications of Microbiology	Hammer	3S	72-73	14
CE 831	Hydraulics	Lewis	3S	72-73	10
CE 910	Ground Water Hydrology	Marlette	3S	71-72	4
CE 915	Water Resources Engineering	Viessman	3S	72-73	5
CE 916	Case Studies in Water Resources	Marlette	3S	72-73	12
CE 926	Advanced Water Treatment	Andersen	3S	72-73	7
CE 927	Advanced Waste Treatment	Hammer	3S	72-73	5
CE 929	Industrial Waste Lab.	Andersen	1S	72-73	6
CE 930	Water Quality & Pollution	McGhee	3S	72-73	7
CE 800	Environmental Quality & Control	Hammer	3S	72-73	60
ChemE 883	Air Pollution	Staff	3S	72-73	8
Zoo 832	Limnology	Hergenrader	4S	72-73	30
AgE 854	Conservation Engineering	Wittmus	3S	72-73	10
AgE 941	Animal Wastes	Cross	3S	71-72	3

Faculty

MARK J. HAMMER
Professor
Civil Engineering
1964

BS	Northwestern University	Civil Engineering	1955
MS	Northwestern University	Civil Engineering	1956
PhD	University of Michigan	Civil Engineering	1964

Biological wastewater processing, advanced waste treatment, eutrophication of lakes and reservoirs

100% (70% teaching, 30% research)

"Anaerobic Lagoon Treatment of Packinghouse Wastewater," Proceedings, 2nd International Symposium for Waste Treatment Lagoons, 1970 (with C. D. Jacobson)

"Treatability of Wastewater from Soluble Coffee Manufacturing," Proceedings, 26th Industrial Waste Conference, Purdue University, 55, 1971 (et al.)

"Eutrophication of Small Reservoirs in the Great Plains," Proceedings, International Symposium on Man-Made Lakes, Knoxville, Tennessee, 1971 (with G. L. Hergenrader)

"Treatability of Wastewater from Soluble Coffee Manufacturing," Procter and Gamble Company, 1968-69

"Eutrophication of Small Reservoirs in the Great Plains," Office of Water Resources Research, 1969-72

Registered professional engineer: Nebraska and Washington

Previous full-time professional experience: 2 yrs. (consulting)

Diplomate, AAEE
Director of Environmental Protection Agency Training Grant in Water Quality Control (1968-73)
Past President, Nebraska Water Pollution Control Association

DEWEY R. ANDERSEN
Associate Professor
Department of Civil Engineering
1968

BS	University of Iowa	Civil Engineering	1958
MS	University of Iowa	Sanitary Engineering	1959
PhD	Iowa State University	Civil Engineering	1967

Municipal and industrial water and wastewater treatment, water quality

100% (65% teaching, 35% research)

"Study of a Complete Mixing Activated Sludge System," Journal Water Pollution Control Federation, 43, 3, 1971 (with Merna Hurd)

"Iron and Manganese Studies of Nebraska Water Supplies," Journal American Water Works Association, 65, 10, 1973 (with D. D. Row and G. E. Sindelar)

"Study of Pharmaceutical Manufacturing Wastewater Characteristics and Aerated Treatment System," Proceedings, 25th Industrial Waste Conference, Purdue University, May 1970; also Water and Sewage Works, March/April 1971 (et al.)

"Soybean Processing--Oil Refining Wastewater: Characteristics and Treatment," Proceedings, 28th Industrial Waste Conference, Purdue University, May 1973 (et al.)

"Water Quality Models for Urban and Suburban Area," Office of Water Resources Research, 12/71-6/74, principal investigator

"Bio-Disc Wastewater Treatment Systems," Engineering Research Center, University of Nebraska, 12/73-6/74

Registered professional engineer: Iowa and Nebraska

Previous full-time professional experience: 6 yrs. (government)

Member, American Society of Civil Engineers
Member, American Water Works Association
Member, Water Pollution Control Federation

TERENCE J. MCGHEE
Associate Professor
Civil Engineering Department
1970

BS	Newark College of Engineering	Civil Engineering	1959
MS	Virginia Polytechnic Institute	Engineering Mechanics	1963
PhD	University of Kansas	Environmental Healtn Engineering	1968

Biological, chemical, and physical treatment of water and wastes; sewage collection; water distribution

100% (70% teaching, 30% research)

"Laboratory Studies on Feedlot Runoff," Journal Environmental Engineering Division, American Society of Civil Engineers, 99, EE6, 1973 (with L. R. Christensen and W. F. Bonneau)

"Aerobic Treatment of Feedlot Runoff," Journal Water Pollution Control Federation, 45, 9, 1973 (with R. L. Torrens and R. J. Smaus)

"Biological Treatment of Feedlot Runoff Following Settling," American Society of Agricultural Engineers Paper No. 73-413, 1973

"Aerobic Treatment of Feedlot Runoff," Office of Water Resources Research, 7/71-6/72, principal investigator

"Practical Treatment of Feedlot Runoff," Office of Water Resources Research, 7/72-6/74, principal investigator

"Upflow Filtration of Oxidation Pond Effluent," Nebraska Department of Environmental Control, 7/73-6/74, Office of Water Resources Research, 7/74-6/75, principal investigator

Registered professional engineer: Nebraska

Previous full-time professional experience: 8 yrs. (3 yrs. industry, 3 yrs. government, and 2 yrs. academic)

Member, Nebraska Water Works Association; Chairman, Student Activities Committee
Member, Nebraska Water Pollution Control Association; Member, Program Committee
Member, Water Quality Committee, Platte River Level B Study

Students

	68-69	69-70	70-71	71-72	72-73	GRADUATES
Master's	5	10	8	12	7	
Doctoral	0	0	0	0	0	

Facilities

Sanitary engineering laboratory facilities housed in a new building completed in 1971 include a 24-station teaching laboratory, three research rooms, a walk-in constant temperature chamber, and a preparation room.

University of North Carolina-Chapel Hill

Chapel Hill, North Carolina

Department of Environmental Sciences and Engineering
School of Public Health

Environmental Engineering
Public Health

ECPD Accredited--Environmental Engineering
APHA Accredited--Public Health

Dr. Russell F. Christman, Head and Professor
Department of Environmental Sciences
and Engineering
University of North Carolina
Chapel Hill, NC 27514
(919) 966-1171

Dr. Charles M. Weiss, Deputy Head
Department of Environmental Sciences
and Engineering
University of North Carolina
Chapel Hill, NC
(919) 966-1171

March 1974

The Department of Environmental Sciences and Engineering offers programs only at the graduate level. Programs leading to advanced degrees are in five program areas: water resources engineering, air and industrial hygiene, radiological hygiene, environmental chemistry and biology, and environmental management and protection. Study in the first two program areas leads to an MS in environmental engineering for students who matriculate with a baccalaureate engineering degree from an accredited institution.

Interdisciplinary studies are encouraged and the student may become involved in the activities of the UNC Water Resources Research Institute, Institute for Environmental Studies, Triangle Universities Consortium on Air Pollution, UNC Wastewater Research Center, any one of several international programs including the International Program in Sanitary Engineering Design, and some thirty ongoing research projects. Joint programs are offered with the Department of City and Regional Planning in water resources planning and development and the Departments of Physics and Nuclear Engineering at North Carolina State University in radiological hygiene. Courses may be taken at Duke University and North Carolina State University without additional charge.

Departmental students receive financial support in some form from the University. Support includes both nonservice traineeships and fellowships, as well as service appointments for research and teaching for which the in-state tuition is allowed. Scholarships are also available which may be combined with service appointments. Tuition and fees are $2,794 (out-of-state) and $946 (in-state) for twelve months.

Chapel Hill is a small university community located midway between the sea coast and the mountains. It is one of the three institutions of the Research Triangle Park, sharing in these resources with Duke University and North Carolina State University. The Research Triangle Park includes the Research Triangle Institute, the National Environmental Research Center of the Environmental Protection Agency, the National Environmental Health Sciences Center, and many private and public research facilities. Some 19,000 students are enrolled at the University, 7,000 of whom are graduate or professional students.

Admission Requirements

(a) 3.0/4 GPA in undergraduate major.

(b) No absolute minimum score on GRE aptitude. Combined score of more than 1100 expected with minimum scores of about 1200 required for financial support. Advanced examination is not required.

(c) Provisional admission is possible for disadvantaged students and others who, despite poor undergraduate performance, indicate a potential for success. Exemplary work during the first semester must be completed for removal of provisional status.

(d) Minimum of 500 on TOEFL is required with a score of 50 on each section. In general, students from developing countries are not encouraged to apply for the academic program unless they are on faculties in institutions in their home countries.

(e) The undergraduate disciplines normally acceptable for admission include any baccalaureate engineering program, if accredited by ECPD, and science majors in chemistry, biology, physics, and geology. Any students with a minimum of 40 semester hours in the natural sciences including mathematics through calculus, physics, chemistry, and biology may be admissible. Applicants with strong records may make up deficiencies in one of these fields in the graduate program but without graduate credit.

(f) Inasmuch as nonengineers, that is scientists, are candidates for the MSPH, MPH, or MS degrees as well as PhD degrees and not candidates for MSEE degrees, there is no requirement that engineering courses by made up.

(g) Doctoral candidates are required to prepare a statement describing their research interests. Acceptance to the doctoral program requires sponsorship of a faculty member based upon a candidate's interests matching the competence and interests and availability of a faculty member. A personal interview may be required.

Degree Requirements

Degree	Credits[a]	Thesis	Language	Residence	Time (mo.)
MSEE	30S	[b]	No	2S	12[c]
MSPH	30S	[b]	No	2S	12[c]
MPH	30S	[b]	No	2S	12[c]
MS	30S	Yes	No	2S	12[c]
PhD[d]	[e]	Yes	No	4S	36

[a] Degree requirements based on agreement between the candidate and his faculty advisor. Most Master's candidates have a minimum of 36 semester hours with about 6 hours devoted to technical report research. An oral comprehensive examination is required for MS degree.

[b] Technical report is required.

[c] Master's candidates, particularly those with no experience, are often encouraged to remain 21 months.

[d] A research skill, such as computer science or statistics, is usually required for doctoral candidates. Normally a language is required only if doctoral committee feels that language is necessary for performance of the research. Doctoral candidates must pass written and oral examinations as well as to prepare a defense of the dissertation upon completion.

[e] Beyond Master's degree (including research)

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
ENVR 101	Elements of Environmental Hygiene	Weidenkopf	2S	S'74	27
ENVR 111	Man & His Environment	Shiffman	3S	S'74	58
ENVR 115	Applied Electron Microscopy	Fraser	3S	S'74	7
ENVR 118	Quant. Studies for Envir. Sciences	Underwood	5S	Su'72	11
ENVR 122	Water Chemistry	Johnson	4S	F'73	20
ENVR 124	Anal. Meth. in Envir. & Food Sanit.	Turner	3S	F'73	7
ENVR 128	Chemical Oceanography	Lyman Johnson	3S	S'73	11
ENVR 131	Biology in Envir. Science	Little	3S	S'74	7
ENVR 132	Limnology & Water Pollution	Weiss	3S	F'73	7
ENVR 133	Environmental Biology	Little Pfaender	3S	F'73	10
ENVR 134	Environmental Microbiology	Pfaender	3S	S'74	10
ENVR 141	Elements of Air Hygiene	Stern	2S	Su'73	11
ENVR 142	Elements of Industrial Hygiene	Harris Reist	2S	Su'73	8
ENVR 143	Applied Physiology & Toxicology	Fraser	3S	F'73	35
ENVR 144	Air Pollution Measuring, Monitoring & Survey	Jeffries	3S	S'74	9
ENVR 145	Instrumentation & Data Acquisition	Jeffries	3S	F'73	4
ENVR 154	Mgt. of Institutional Environment	Turner	3S	S'74	10
ENVR 161	Elements of Radiological Hygiene	Willhoit	2S	S'74	5
ENVR 162	Modern Physics for Envir. Sciences	Willhoit	3S	F'73	2
ENVR 163	Radiation Instrumentation	Walsh	3S	F'73	5
ENVR 164	Field Observations in Rad. Hygiene	Chanlett	3S	Su'72	4
ENVR 171	Prin. of Water Quality Mgt.	Lamb	2S	F'73	17
ENVR 173	Design of Hydraulic Structures	McJunkin	3S	F'73	12
ENVR 174	Water & Wastes Treat. Processes	Singer	3S	S'74	17
ENVR 175 ENVR 181	Sanitary Engr. Design in Developing Countries	Lauria	3S	F'74	11
ENVR 181	Ground Water Hydrology	Sherwani	3S	F'74	9
ENVR 182	Water Resources Planning in Developing Countries	McJunkin	3S	F'73	14
ENVR 183	Special Topics in Water Resources	Howells	1S	F'73	14
ENVR 211	Environmental Management	Shiffman	3S	Su'73	33
ENVR 212	Planning & Development of Envir. Hygiene Programs	Shiffman	3S	S'74	5
ENVR 214	Envir. Issues & Decisions	Weiss	2S	F'73	5
ENVR 215	Envir. Assessment	McJunkin	2S	S'74	14
ENVR 217	Systems Analysis in Envir. Planning	Sherwani	3S	F'74	15
ENVR 218	Environmental Systems Analysis I	Sherwani	3S	S'74	3
ENVR 219	Environmental Systems Analysis II	Moreau	3S	S'73	15
ENVR 221	Instrumental Methods of Analysis	Shuman	4S	S'74	4
ENVR 222	Special Topics in Aquatic Chemistry	Johnson	2S	F'72	4
ENVR 223	Trace Analysis	Shuman	4S	S'73	6
ENVR 232	Special Topics in Aquatic Biology	Kuenzler	2S	S'74	8
ENVR 233	Microbial Ecology	Staley	4S	F'73	5
ENVR 235	Ecology of Phytoplankton	Kuenzler	3S	F'73	9
ENVR 241	Mechanics of Aerosols	Reist	3S	F'73	21
ENVR 242	Industrial Hygiene Practices	Fraser	3S	S'74	20
ENVR 243	Air & Its Contaminants	Stern	3S	F'73	15
ENVR 244	Industrial Hygiene Lab.	Reist	3S	S'74	10
ENVR 245	Air Pollution Control	Stern	3S	S'74	7
ENVR 246	Biological Effects of Air Pollution	Ripperton	3S	F'72	6
ENVR 247	Chemistry of the Troposphere	Fox	3S	F'73	9
ENVR 248	Industrial Medicine	Fraser	3S	S'74	12
ENVR 249	Air Pollution Meteorology	Peterson	3S	S'74	5
ENVR 251	Environmental Sanitation I	Chanlett	3S	F'74	8
ENVR 252	Food Protection	Turner	3S	S'73	11
ENVR 253	Environmental Sanitation II	Turner	3S	S'74	6
ENVR 255	Solid Wastes	Singer	2S	S'74	3
ENVR 261	Radiation Biophysics	Willhoit	3S	S'73	4
ENVR 262	Health Physics	Willhoit	3S	Su'71	5

ENVR 263	Radiation Hazards Evaluation I	Walsh	3S	S'74	4
ENVR 264	Radiation Hazards Evaluation II	Underwood	3S	S'72	4
ENVR 271	Modeling in Natural Aquatic Systems	O'Melia Lauria	3S	S'74	6
ENVR 272	Water Supply & WW Disposal Systems	Lauria	3S	F'73	10
ENVR 273	W & WW Treatment Plant Design	Brown	3S	S'73	6
ENVR 274	Chemical Reaction Engineering	O'Melia	4S	F'71	5
ENVR 275	Industrial Water Quality Mgt.	Lamb	3S	S'74	5
ENVR 276	Advanced Treatment Processes	Lamb	2S	Su'71	9
ENVR 277	Engineering Project Design	Sherwani	3S	Su'73	5
ENVR 281	Topics in Advanced Hydrology	Sherwani	3S	S'70	3
ENVR 283	Natural Resource Law & Policy	Campbell	3S	S'74	27
ENVR 285	Special Project in Water Quality Plan.	Lamb	3S	Su'73	7
ENVR 282	Public Investment Theory & Techniques	Hufschmidt	3S	F'73	12
ENVR 284	Planning of Water Resource System	Moreau	3S	S'74	5
ENVR 313	Envir. Health Problems in Developing Countries	Shiffman	1S	F'72	9
BIOS 105	Principles of Statistical Inference	Davis Kuebler	3S	F'73	95
BIOS 135	Probability & Statistics	Kupper	4S	F'73	8
EPID 162	Epidemiology in Envir. Health	Gruber McMichael	2S	F'73	48
COMP 216x	Intro. to Computer Use in Science & Mathematics	Staff	3S	S'73	15

All Master's level students in the Department follow a program of study developed with the faculty advisor. In general, BIOS 105, EPID 162, and ENVR 211 are required of all students and other required courses are assigned depending on the specialization selected. Engineering students are required to take BIOS 135 and one other course in the School of Public Health outside the Department and may select other courses from required areas.

Faculty

RUSSELL F. CHRISTMAN
Professor and Head
Department of Environmental Sciences and Engineering
1973

BS	University of Florida	Chemistry	1958
PhD	University of Florida	Chemistry	1962

Chemical aspects of natural environmental systems, chemistry of natural waters, atmospheric chemistry, regional environmental planning

100% (50% administration, 25% teaching, 25% research)

The Natural Environment and the Control of Wastes, Goodyear Division, Prentice-Hall, 1973 (et al.)

"Properties of the Yellow Organic Acids of Natural Waters," Journal Limnology and Oceanography, 13, 4, 1968 (with M. Ghassemi)

"Chemical Nature of Organic Color in Water," Journal American Water Works Association, 58, p. 723, 1966 (with M. Ghassemi)

Previous full-time professional experience: 11 yrs. (academic)

Member, AEEP
Member, Panel on Public Water Supplies for the Revision of Federal Water Quality Criteria, National Academy of Sciences (1972)
Member, Grant Review Board, US Environmental Protection Agency, Division of Manpower Training, Office of Water Programs (1970-date)

Member, Editorial Advisory Board, Environmental Science and Technology
Consultant, US Environmental Protection Agency, Evaluation of Federal Training Program Status (1974)

JAMES C. BROWN
Associate Professor of Sanitary Engineering and
Director, UNC Wastewater Research Center
Department of Environmental Sciences and Engineering
1962

BS	Illinois Institute of Technology	Civil Engineering	1949
MS	Case Institute of Technology	Sanitary Engineering	1961

Design of water and wastewater treatment systems, process development in wastewater treatment, regional management of wastewater collection and treatment systems

100% (20% teaching, 30% research, 50% administration)

"Physical Behavior of Flocculent Suspensions in Upflow," Journal Sanitary Engineering Division, American Society of Civil Engineers, SA2, April 1971 (with F. LaMotta)

"An Investigation of Curricula Materials and Methodology for Training Operators of Wastewater Treatment Plants," Water Resources Research Institute of the University of North Carolina, Report No. 74, 1972

"Variation in Characteristics of Wastewater Influent at the Mason Farm Wastewater Treatment Plant," UNC Wastewater Research Center, Report No. 13, 1970 (with R. Hanson and W. Walker)

"Chemical Treatment of Trickling Filter Effluent," US Environmental Protection Agency, 2/72-12/72, project director

"Fine Solids Removal Following Chemical Treatment of Trickling Filter Effluent," US Environmental Protection Agency, 2/73-3/74, project director

Registered professional engineer: New York and Ohio

Previous full-time professional experience: 12 yrs. (10 yrs. industry and 2 yrs. consulting)

Vice President, United States Section, Inter American Association of Sanitary Engineers
Member, Water Pollution Control Federation; Member, Personnel Advancement Committee

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EMIL T. CHANLETT
Professor of Sanitary Engineering
Department of Environmental Sciences and Engineering
1946

BS	College of the City of New York	Chemistry and Biology	1937
MSPH	Columbia University	Sanitary Science	1939
MSSE	University of North Carolina	Sanitary Engineering	1941

Radiological hygiene, solid wastes management, environmental sanitation

100% (50% teaching, 50% research)

Environmental Protection, McGraw-Hill Publishers, April 1973

"Plan for the Assimilation of Wastes," Journal Environmental Health, 34, 2, 1971

"Environmental Services in Public Health--1970 Developments," in 1971 Brittanica Yearbook, Encyclopedia Brittanica, Chicago, 1971

"The Necessity for Environmental Health Planning," American Association of Public Health Journal, 62, 12, 1971

"Radiological Health Training Grant," US Environmental Protection Agency, 7/69-6/74, program director

Previous full-time professional experience: 8 yrs. (2 yrs. academic and 6 yrs. government)

Consultant, US Atomic Energy Commission Atomic Safety and Licensing Panel (1972)
Member, American Industrial Hygiene Association; Member, Committee on Education (1965-date)
Chairman, North Carolina State Board of Refrigeration Examiners
Member, North Carolina Atomic Energy Advisory Committee (1959-date)
Member, Governor's Occupational Health Council (1958-date)

DONALD L. FOX
Lecturer
Department of Environmental Sciences and Engineering
1973

BS	Wichita State University	Chemistry	1965
PhD	Arizona State University	Physical Chemistry	1971

Atmospheric photochemical processes concerning reactions of hydrocarbons and oxides of nitrogens, interaction of gas phase in the formation of aerosols, sources and cycles of trace constituents in the atmosphere, identification of products of photochemical reactions

100% (15% teaching, 85% research)

"Experimental Tests of Air Pollution Control Strategies," US Environmental Protection Agency, 7/72-6/74, co-principal investigator

"Experimental Study of Aerosol Formation Mechanisms in a Controlled Atmosphere," US Environmental Protection Agency, 5/73-5/76, co-principal investigator

"Determination of PAN in Photochemical Smog Simulation Reactions," University of North Carolina, 4/73-4/74, principal investigator

Member, American Chemical Society
Member, Air Pollution Control Association
EPA Post-Doctoral Fellow, University of North Carolina-Chapel Hill

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DONALD E. FRANCISCO
Lecturer in Environmental Chemistry and Biology
Department of Environmental Sciences and Engineering
1973

BA	North Texas State University	Biology	1964
MA	North Texas State University	Biology	1966
PhD	University of North Carolina-Chapel Hill	Environmental Chemistry & Biology	1971

Effect of pollutants on aquatic systems, limnological investigations of eutrophication occurrence and control, wastewater treatment, aquatic microbial ecology

100% (10% teaching, 70% research, 20% administration)

"Preimpoundment Studies, Falls Project Water Quality Characteristics," Environmental Sciences and Engineering Publication No. 328, 1973 (with C. M. Weiss and D. R. Lenat)

"Algal Response to Detergent Phosphate Levels," Journal Water Pollution Control Federation, 45, 3, 1973 (with C. M. Weiss)

"Activated Sludge Modification for Enhancement of Trickling Filter Plant Performance," Proceedings, 20th Southern Water Resources and Pollution Control Conference, Chapel Hill, April 1971 (with L. Little and J. C. Lamb)

"Acridine Orange--Epifluorescence Technique for Counting Bacteria in Natural Waters," Transactions American Microscopical Society, 92, 3, 1973 (with R. A. Mah and A. C. Rabin)

"A Determination of Potential and Acute Effects of an Industrial Chrome Waste upon the Community Structure of the Receiving Stream," Diamond Shamrock Chemical Company, 4/72-7/74, principal investigator

"Availability of Aluminum Phosphate in Alum-Treated Wastewaters for Algal Growth," Water Resources Research Institute, University of North Carolina, 7/73-7/74, principal investigator

"Water Quality Modeling and Intensive Survey of the Upper Haw River," North Carolina Office of Water and Air Resources, 7/73-2/74, co-principal investigator

DAVID A. FRASER
Professor of Industrial Hygiene
Department of Environmental Sciences and Engineering
1961

BA	University of Pennsylvania	Chemistry	1947
MS	Xavier University	Chemistry	1956
ScD	University of Cincinnati	Industrial Health	1961

Industrial hygiene, aerosols, electron microscopy, air sampling, physiologic effects

100% (40% teaching, 20% research, 40% administration)

"Sizing Methodology," Chapter 14 in The Industrial Environment--Its Evaluation and Control, Government Printing Office, Washington, 1973 (in press)

"Adsorption of Sulfur Dioxide on Particulate Surfaces," American Petroleum Institute Publication No. 4079, New York, 1971

"Ventilation for Hot Processes," American Industrial Hygiene Journal, 34, 11, 1973 (with G. Siebert)

"Ciliary Activity and Pulmonary Retention of Inhaled Dust in Rats Exposed to Sulfur Dioxide," accepted for publication, Journal Air Pollution Control Association (with M. C. Battigelli and H. M. Cole)

"A Model for the Deposition of Microscopic Fibers in the Human Respiratory System," "Factors Affecting the Collection Efficiency of the Induced-Air Venturi Scrubber," "Flindic Devices for Counting Airborne Dust Particles," National Institutes of Occupational Safety and Health, Occupational Health Training, 7/70-6/73, research director

Previous full-time professional experience: 13 yrs. (2 yrs. industry and 11 yrs. government)

Member, American Industrial Hygiene Association; Treasurer (1970-73); Board of Directors (1973)
Member, Committee on Education and Training, National Institute of Occupational Safety and Health (1972-date)

ROBERT L. HARRIS
Associate Professor of Environmental Engineering
Occupational Health Studies Group
Institute for Environmental Studies
1973

BS	University of Arkansas	Chemical Engineering	1949
MS	Harvard University	Environmental Engineering	1954
PhD	University of North Carolina	Environmental Sciences & Engineering	1972

Industrial hygiene engineering, fluid mechanics, aerosol mechanics

100% (15% teaching, 40% research, 45% administration)

"A Model for Deposition of Fibers in the Human Respiratory System," American Industrial Hygiene Association Journal, in press (with D. A. Fraser)

"Digital Computer Simulation of Complex Radiant Heat Load," Environmental Research, 5, 1972

"Uranium Mine Ventillation for Control of Radon and Its Daughter Products," Proceedings, Symposium on Radiological Health and Safety in Mining and Milling of Nuclear Materials, Vienna, 1964 (with P. E. Bales)

"Rubber Industries Health Studies," United Rubber Workers Union, Goodyear, Firestone, Uniroyal, General Companies, 10/71-date, co-investigator

Previous full-time professional experience: 20 yrs. (government)

Member, American Industrial Hygiene Association
Member, National Institute for Occupational Safety and Health Criteria Review Committees: Labelling, Fibrous Glass, Silica
Member, American Board of Industrial Hygiene, Professional Certification in Engineering Practice

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HARVEY E. JEFFRIES
Assistant Professor of Air Hygiene
Department of Environmental Sciences and Engineering
1972

BS	Florida Presbyterian College	Chemistry	1964
MSPH	University of North Carolina	Atmospheric Chemistry	1967
PhD	University of North Carolina	Atmospheric Chemistry	1971

Clarification of fundamental atmospheric chemical and meteorological processes, studies of the chemical basis for air quality standards, examination of methods for obtaining massive amounts of data from large experiments, development of new instrumental methods for air quality monitoring, application and validation of computer simulation models of photochemical smog

100% (25% teaching, 70% research, 5% administration)

"Natural Synthesis of Ozone in the Troposphere," Journal Environmental Science, 5, 1971 (with L. A. Ripperton and J. J. B. Worth)

"Formation of Aerosols by Reaction with Selected Hydrocarbons," American Chemical Society Advances in Chemistry Series 113, Photochemical Smog and Ozone Reactions, pp. 210-213, 1972 (with L. A. Ripperton and O. White)

"Organic Matter in Marine Light Scattering Aerosols," Final Report to US Navy Weather Research Facility, Norfolk, Virginia, Contract No. N62306-69-C0383, NWRF A2-0471-160, 1971 (with L. A. Ripperton)

"Experimental Tests of Air Pollution Control Strategy," US Environmental Protection Agency, 6/72-6/74, principal investigator

"Physical and Chemical Factors Affecting Ozone Concentration in the Lower Atmosphere," National Science Foundation, 1/72-6/73, co-principal investigator

"Development of a Photon Counting Chemiluminescent Ozone Meter," University Research Council, 1/72-11/73, principal investigator

Previous full-time professional experience: 2 yrs. (academic)

J. DONALD JOHNSON
Professor of Environmental Chemistry
Department of Environmental Sciences and Engineering
1962

BS	University of California	Chemistry	1957
PhD	University of North Carolina	Analytical Chemistry	1962

Chemistry of chlorine and bromine compounds, disinfection of virus, ion flotation processes, analytical methods development for water

100% (40% teaching, 40% research, 20% administration)

"Bromine and Bromamine Disinfection Chemistry," Journal Sanitary Engineering Division, American Society of Civil Engineers, 97, SA5, and Proceedings, National Specialty Conference on Disinfection, October 1971 (with R. Overby)

"Stabilized Neutral Orthotolidine, SNORT, Colorimetric Method for Chlorine," Analytical Chemistry, 41, 13, November 1969 (with R. Overby)

"Heat Shocked Bacillus Subtilis Spores as an Indicator of Virus Disinfection," Journal American Water Works Association, 62, 9, 1970 (with G. Toenniessen)

"Bromine Residual Chemistry," US Army Medical Research Development, 10/71-9/73, principal investigator

Vice-Chairman, Residual Chlorine Joint Task Group, 14th edition, Standard Methods (Water Pollution Control Federation, American Water Works Association, American Public Health Association)
Member, American Water Works Association; Member, Research Subcommittee on Chlorine
Member, Water Pollution Control Federation; Chairman, Halogen Subcommittee of Committee on Standard Methods

EDWARD J. KUENZLER
Professor of Environmental Biology
Department of Environmental Sciences and Engineering
1965

BS	University of Florida	Biology	1951
MS	University of Georgia	Ecology	1953
PhD	University of Georgia	Ecology	1959

Phytoplankton ecology, estuarine ecology, biological oceanography, nutrient cycling

100% (60% teaching, 30% research, 10% administration)

"Dissolved Organic Phosphorus Excretion by Marine Phytoplankton," Journal of Phycology, 6, 1970

"Elimination and Transport of Cobalt by Marine Zooplankton," in Symposium on Radioecology (D. J. Nelson and F. C. Evans, eds.), USAEC CONF-670503, US Department of Commerce, 1969

"Phosphatases of Marine Algae," Biological Bulletin, 128, 1965 (with J. Perras)

"Phosphorus Turnover by Coral Reef Animals," in Symposium on Radioecology (D. J. Nelson and F. C. Evans, eds.), USAEC CONF-670503, US Department of Commerce, 1969 (with L. Pomeroy)

"Mangrove Swamp System," in Coastal Ecological Systems of the United States: A Source Book for Estuarine Planning (et al., eds.), Report to the Federal Water Pollution Control Administration, in press, 1973

"Optimum Ecological Designs for Estuarine Systems," National Oceanic and Atmospheric Agency, Sea Grant, 1/68-3/73, co-principal investigator

"Effects of Mosquito-Control Ditching on Estuarine Ecosystems," Water Resources Research Institute, 1/71-12/72, principal investigator

Previous full-time professional experience: 8 yrs. (academic)

Program Director, Biological Oceanography Program, National Science Foundation
Member, Advisory Panel, Research Applied to National Needs, National Science Foundation
Member, American Society of Limnology and Oceanography; Member, Nominating Committee

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JAMES C. LAMB
Professor of Sanitary Engineering
Department of Environmental Sciences and Engineering
1959

BS	Virginia Military Institute	Civil Engineering	1947
SM	Massachusetts Institute of Technology	Sanitary Engineering	1948
SE	Massachusetts Institute of Technology	Sanitary Engineering	1952
ScD	Massachusetts Institute of Technology	Sanitary Engineering	1953

Water quality management, stream pollution, industrial wastes, treatment processes, water resources planning

100% (50% teaching, 30% research, 20% administration)

"Advanced Treatment of Municipal Wastewaters--A Survey of Current Practices," a three-part slide/tape program (revised) originally presented before the North Carolina Water Pollution Control Association, Wilmington, North Carolina, November 1973, in press

"Guidelines for the Control of Industrial Wastes," four publications of the World Health Organization, Geneva (Metal Finishing, Livestock, Pulp and Paper and Cane Sugar Industries), 1972-73

"Water--Its Use and Abuse," a three-screen slide/tape program, Department of Environmental Sciences and Engineering, University of North Carolina, 1973

"Methods for Transferring Research Finding to Practicing Engineers," Water Resources Research Institute, 7/72, principal investigator

"Reverse Osmosis for Removal of Metals from Water," Research Triangle Institute, 4/72, principal investigator

"Effects of Dyes on Fish and Algae," American Dye Manufacturers Institute, 9/72, principal investigator

Registered professional engineer: North Carolina and Virginia

Previous full-time professional experience: 8 yrs. (4 yrs. academic and 4 yrs. industry)

Diplomate, AAEE
Member, American Society of Civil Engineers
Honor Member, Chi Epsilon

DONALD T. LAURIA
Associate Professor
Department of Environmental Sciences and Engineering
1965

BCE	Manhattan College	Sanitary Engineering	1956
MSSE	Syracuse University	Sanitary Engineering	1965
PhD	University of North Carolina-Chapel Hill	Water Resources Engineering	1970

Water demand forecasting for states and regions, regional wastewater planning, timing and scale of capacity expansions of water and wastewater facilities, integer and mixed integer programming, water supply in developing countries, modeling streams and estuaries, water and wastewater process design

100% (60% teaching, 30% research, 10% administration)

"Water Supply Planning by Mixed Integer Programming," presented at American Geophysical Union, Washington, 1972

"Planning Small Supplies in Developing Countries," Report to the Office of Health, US Agency for International Development, Washington, 1972

"Water Supply Planning in Developing Countries: A General Statement," Journal American Water Works Association, 65, 9, pp. 583-587, September 1973

"Oxidation of Ferrous Iron: The Application of Chemical and Economic Concepts to Process Design," presented at the 14th Water Quality Conference, University of Illinois-Champaign, 1972 (with C. R. O'Melia and W. J. Snodgrass)

"Water Demand Forecasting for State Level Planning," Water Resources Research Institute, 7/72-6/74, principal investigator

"A Mixed Integer Programming Model for Regional Sewerage Planning," National Science Foundation, 4/73-9/74, principal investigator

Registered professional engineer: North Carolina and New York

Previous full-time professional experience: 9 yrs. (4 yrs. industry and 5 yrs. consulting)

Member, American Society of Civil Engineers
Member, American Water Works Association
Member, American Geophysical Union

LINDA W. LITTLE
Assistant Professor of Environmental Biology
Department of Environmental Sciences and Engineering
1971

BA	University of North Carolina-Greensboro	Biology	1959
MSPH	University of North Carolina-Chapel Hill	Sanitary Biology & Chemistry	1962
PhD	University of North Carolina-Chapel Hill	Environmental Microbiology	1968

Environmental biology, advanced waste treatment (nitrogen and phosphorus removal), industrial waste treatment, effects of industrial waste on biological treatment and on biota of receiving streams

100% (60% teaching, 40% research)

"Phosphorus in Water and Wastewater: An Annotated Selected Bibliography," University of North Carolina Wastewater Research Center Report 11, Chapel Hill, 1970

"Nitrification and Denitrification: A Selected Bibliography," University of North Carolina Wastewater Research Center Report 14, Chapel Hill, 1971

"Activated Sludge Modifications for Enhancement of Trickling Filter Plant Performance: II. Nitrification," Proceedings, 20th Annual Water Resources and Pollution Control Conference, 1971 (with D. E. Francisco and J. C. Lamb)

"Ammonia Production in Urea-Grown Cultures of Chlorella ellipsoidea," Journal of Phycology, 6, 1970 (with R. A. Mah)

"Enhanced Nitrification by Addition of Clinoptilolite to Tertiary Activated Sludge Units," Environmental Letters, 4, 1, 1971 (with R. Sims)

"Characterization and Treatment of Brine Wastes from the Cucumber Pickle Industry," University of North Carolina Water Resources Research Institute, Pickle Packers International, Inc., 1974

"Evaluation of Acute Effects of Dyes on Fish and on Growth and Photosynthetic Activities of Algae," "Effect of Treatment on Toxicity of Dyes on Algae," American Dye Manufacturers Institute, co-principal investigator

"Improvement of Trickling Filter Plant Performance," Water Quality Office, US Environmental Protection Agency, 1970-73 (J. C. Lamb, principal investigator)

Previous full-time professional experience: 4 yrs. (2 yrs. research and 2 yrs. academic)

Member, Sub-Committee, Fish Bio-Assay of the Committee for the Revision of Standard Methods for the Examination of Waters and Wastewaters (1973)

F. EUGENE MCJUNKIN
Associate Professor of Environmental Engineering and
Associate Director, Water Resources Research Institute of North Carolina
Department of Environmental Sciences and Engineering
1966

Water resources design and development, thermal power plant effects, dual water supply studies, control of schistosomiasis

100% (25% teaching, 25% research, 50% administration)

"Community Water Supply in Developing Countries: A Quarter Century of United States Assistance," Agency for International Development, Washington, 1969

"Engineering Measures for the Control of Schistosomiasis," Agency for International Development, Washington, 1971

"The Role of Plastic Pipe in Community Water Supplies in Developing Countries," US Government Printing Office, Washington, 1971 (with C. Pineo)

"Surveillance of Drinking Water Quality," World Health Organization, 1974

"Feasibility of On-Line Computer Information Service in Water Resources," US Office of Water Resources Research and North Carolina Water Resources Research Institute, 1971-date

Registered professional engineer: Virginia

Previous full-time professional experience: 11 yrs. (6 yrs. consulting and 5 yrs. academic)

Special Assistant to the Director, North Carolina Office of Water and Air Resources (1971-date)
Director, American Water Resources Association (1966-69)
Editor, Water Supply and Sanitation in Developing Countries (1966-69)

DANIEL A. OKUN
Professor of Environmental Engineering and Head
Department of Environmental Sciences and Engineering
1952

BSCE	Cooper Union Institute of Technology	Civil Engineering	1937
MSCE	California Institute of Technology	Civil Engineering	1938
ScD	Harvard University	Sanitary Engineering	1948

Water supply, wastewater collection and disposal, water quality management, regionalization

100% (25% teaching, 25% research, 50% administration)

Elements of Water and Wastewater Engineering, John Wiley and Sons, Inc., New York, 1971 (with G. Fair and J. Geyer)

Water and Wastewater Engineering, Volume I: Water Supply and Wastewater Removal, Volume II: Water Purification and Wastewater Treatment and Disposal, John Wiley and Sons, Inc, New York, 1968 (with G. Fair and J. Geyer)

"Health Aspects of Water Management," Public Works and Society, Joint Conference of American Society of Civil Engineers and Institution of Civil Engineers (United Kingdom), Buena Vista, Florida, 1972

"New Direction in Wastewater Collection and Disposal," Journal Water Pollution Control Federation, 43, 1971; also in Clean Water for Our Future Environment, American Society of Civil Engineers, 1971

"Alternatives in Water Supply," Journal American Water Works Association, 61, 5, 1969

"Study of the Reorganization of Water Management in England," Rockefeller Foundation, 7/73-6/74, principal investigator

"Regional Development of Public Water Supply Systems," University of North Carolina Water Resources Research Institute, 7/72-7/73, principal investigator

Registered professional engineer: North Carolina and New York

Previous full-time professional experience: 10 yrs. (4 yrs. consulting and 6 yrs. government)

Member, AEEP
Diplomate, AAEE
Member, National Academy of Engineering (1973)
President, American Academy of Environmental Engineers (1969-70)
Member, American Society of Civil Engineers; Chairman Executive Committee, Environmental Engineering Division (1967-68)
More than 30 consultantships to local, state, national and international agencies; to industry; and to consulting firms

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CHARLES R. O'MELIA
Professor of Environmental Engineering
Department of Environmental Sciences and Engineering
1966

BCE	Manhattan College	Civil Engineering	1955
MSE	University of Michigan	Sanitary Engineering	1956
PhD	University of Michigan	Sanitary Engineering	1963

Water chemistry, water and wastewater treatment processes, modeling of natural aquatic systems

100% (50% teaching, 40% research, 10% administration)

"An Approach to the Modeling of Lakes," Schweizerische Zeitschrift für Hydrobiologie, 60, 34, 1972

"Water and Wastewater Filtration: Concepts and Applications," Environmental Sciences and Technology, 5, 1971 (with K. M. Yao and M. T. Habibian)

"Coagulation in Water and Wastewater Treatment," in Advances in Water Quality Improvement--Physical and Chemical Processes (E. F. Gloyna and W. W. Eckenfelder, eds.), University of Texas Press, Austin 1970

"Phosphorus Cycling in Lakes," Water Resources Research Institute, 7/73-6/74, principal investigator

Registered professional engineer: Georgia

Previous full-time professional experience: 9 yrs. (2 yrs. consulting and 7 yrs. academic)

FREDERIC K. PFAENDER
Assistant Professor
Department of Environmental Sciences and Engineering
1971

BS	California State College-Long Beach	Microbiology	1966
MS	California State College-Long Beach	Microbiology	1968
PhD	Cornell University	Microbiology	1971

Environmental microbiology, pollutant metabolism, distribution and fate of organic pollutants, microbial activities in estuarine ecosystems

100% (40% teaching, 50% research, 10% administration)

"Effect of Nutrient Additions on the Apparent Cometabolism of DDT," Journal Agricultural and Food Chemistry, 21, 1973 (with M. Alexander)

"Extensive Microbial Degradation of DDT in Vitro and DDT Metabolism by Natural Communication," Journal Agricultural and Food Chemistry, 20, 1972 (with M. Alexander)

"DDT Metabolism in Vitro and in Vivo," Bacteriological Proceedings, 1971 (with M. Alexander)

"Nature, Origin and Fate of Chemical Agents in Water," in Handbook of Physiology, American Physiological Society, 1974

"Development of an Improved Method for Monitoring Pesticides and Heavy Metals in North Carolina," Water Resources Research Institute, 7/73-6/74, co-principal investigator

Member, American Society for Microbiology
Member, American Society for Limnology and Oceanography

PARKER C. REIST
Professor of Air and Industrial Hygiene
Department of Environmental Sciences and Engineering
1972

BS	Pennsylvania State University	Sanitary Engineering	1955
SM	Massachusetts Institute of Technology	Sanitary Engineering	1957
SM	Harvard School of Public Health	Hygiene	1963
ScD	Harvard School of Public Health	Hygiene (Radiological Health)	1966

Physics of aerosols, aerosol sampling and monitoring, industrial hygiene, air pollution control techniques

100% (50% teaching, 50% research)

"The Scanning Electron Microscope in Air Pollution Studies," Clean Air, 6, p. 26, 1972

"Respirator Usage in Coal Mines," Annals of the New York Academy of Sciences, 200, p. 698, 1972 (et al.)

"Improved Pulsation Dampener for Use with Mass Respirable Sampling Devices," American Industrial Hygiene Association Journal, 33, 1972 (with P. A. LaViolette)

"Neutralizing Charged Aerosols with Radioactive Sources," Journal Colloids and Interface Science, 45, p. 17, 1973 (with D. Cooper)

"Small Particles in the Atmosphere," American Institute of Chemical Engineers Symposium Series, Air-1972 (Charanjit Rai, ed.), 1971 (in press)

"Experimental Study of Aerosol Formation Mechanisms in a Controlling Atmosphere," US Environmental Protection Agency, 6/73-date, principal investigator

"Study of Space Cabin Environment," National Aeronautics and Space Administration, 7/66-7/71, co-principal investigator

"Study of Nucleated Condensation Processes," University of North Carolina General Research Support, 1/73-12/73, principal investigator

Registered professional engineer: Pennsylvania

Previous full-time professional experience: 12 yrs. (5 yrs. government and 7 yrs. academic)

Chairman, Triangle Universities Consortium on Air Pollution
Member, American National Standards Subcommittee Z.88.6

LYMAN A. RIPPERTON
Professor of Air Hygiene
Department of Environmental Sciences and Engineering
1958

BA	University of Texas	Government	1942
BS	University of Texas	Chemistry	1946
PhD	University of Texas	Biochemistry	1953

100% (45% teaching, 45% research, 10% administration)

"Relationship of Measurements in Non-Urban Air to Air Pollution: Ozones and Oxides of Nitrogen," Proceedings, 2nd International Clean Air Congress, Academic Press, 1971 (with H. E. Jeffries and J. J. B. Worth)

"Gas Phase Destruction in Tropospheric Ozone," Journal Geophysical Research, 760, 1971 (with F. M. Vukovich)

"Chemical and Environmental Factors Affecting Ozone Concentration in the Lower Troposphere," National Science Foundation, 6/65-6/73, principal investigator

"Environmental Test of Air Pollution Control Strategy," US Environmental Protection Agency, 6/72-6/74, principal investigator

Previous full-time professional experience: 5 yrs. (2 yrs. research and 3 yrs. government)

Member, Air Pollution Control Association; Past Chairman, South Atlantic States Section; Member, Atmospheric Reactions Committee
Member, American Chemical Society; organized Symposium on Atmospheric Reactions of Ozone (proceedings incorporated in American Chemical Society Series, 113)

JABBAR K. SHERWANI
Associate Professor of Systems Analysis and Hydrology
Department of Environmental Sciences and Engineering
1962

BS	University of Punjab	Physics & Chemistry	1942
BS	Lahore, Pakistan	Civil Engineering	1945
MCE	Polytechnic Institute of Brooklyn	Hydraulic Engineering & Structures	1947
PhD	University of Utah	Groundwater Hydrology	1951
MPA	Harvard University	Water Resources & Economics	1958

Systems approach to water quality planning and management, analysis of hydrologic systems, water quality monitoring of streams

100% (50% teaching, 50% research)

"Computer Simulation of Groundwater Aquifers of the Coastal Plain of North Carolina," Report No. 75, Water Resources Research Institute of the University of North Carolina, 1973

"Effect of Low-Flow Hydrologic Regimes on Water Quality Management," Report No. 26, Water Resources Research Institute of the University of North Carolina, 1971

"Groundwater Development," Chapter 5 in Elements of Water Supply and Wastewater Disposal (Fair et al., eds.), John Wiley and Sons, Inc., 1971

"Computer Simulation of Groundwater Aquifers of the Coastal Plain of North Carolina," Water Resources Research Institute, 7/69-12/72, principal investigator

"Strategies for Water Quality Monitoring by State Agencies," Water Resources Research Institute of the University of North Carolina, 7/72-6/74, principal investigator

Previous full-time professional experience: 13 yrs. (3 yrs. academic and 10 yrs. government)

Consultant, Agency for International Development, White House-Interior Panel on Waterlogging and Salinity in West Pakistan

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MORRIS A. SHIFFMAN
Professor of Environmental Health
Department of Environmental Sciences and Engineering
1964

DVM	Middlesex University	Veterinary Medicine	1944
MPH	University of Michigan	Environmental Health	1945
Docteur-Veterinaire	National Veterinary College (Alfort, France)	Veterinary Microbiology	1949
MGA	University of Pennsylvania	Government Administration	1957
PhD	University of Pennsylvania	Political Science	1967

Environmental management, environmental planning, community environmental protection, food protection, environmental health in developing countries

100% (60% teaching, 20% research, 20% administration)

"Environmental Health and Mental Health," in Mental Health Considerations in Public Health (S. E. Goldston, ed.), Public Health Service Publication No. 1898, 1968 (with D. Leighton and E. Mood)

"Systems Approach Applications in Regulatory Veterinary Medicine," Proceedings, 72nd Annual Meeting of the US Livestock Health Association, 1969

"The Use of Standards in the Administration of Environmental Pollution Control Programs," American Journal of Public Health, 60, 1970

"Current Status of Food Handler Examinations in State and Local Health Departments," Journal Milk and Food Technology, 33, July 1970 (with C. Becker)

"The Development and Evaluation of Measures to Reduce Food Waste Caused by Intestinal Disease," Agency for International Development, 6/71-3/77, principal investigator

"Evaluation of Methods to Improve the Effectiveness of Food Protection Programs," World Health Organization, 1/72-12/73, principal investigator

Previous full-time professional experience: 18 yrs. (1 yr. industry and 17 yrs. government)

Consultant, World Health Organization (various committees and scientific groups) (1961-date)
Member, Scientific Advisory Committee, Pan American Zoonoses Center, WHO (1961-date)
Member, American Public Health Association; Member, Food Protection Committee (1960-date)

MARK S. SHUMAN
Assistant Professor of Environmental Chemistry
Department of Environmental Sciences and Engineering
1970

BS	Washington State University	Chemistry	1959
PhD	University of Wisconsin	Chemistry	1966

Electroanalytical chemistry, trace analysis, analytical chemistry, water chemistry

100% (50% teaching, 50% research)

"Atheroschlerosis and Hypertension in Relation to Some Trace Elements in Tissues," World Review of Nutrition and Dietetics, 15, 1973 (with W. Voors and P. Gallagher)

"Zinc and Cadmium Levels for Cardiovascular Disease in Geographical Context," presented at the 6th Conference on Trace Substances in Environmental Health, University of Missouri, 1972 (with W. Voors and P. Gallagher)

"Analysis of Submicrogram Quantities of Cd, Zn, Cu and Pb in Human Tissues by Anodic Stripping Voltammetry," presented to the 6th Conference on Trace Substances in Environmental Health, University of Missouri, 1972

"Trace Metal Association with Dissolved Organic Matter in Sea Water," National Science Foundation, 1/73-6/74, principal investigator

"Development of an Improved System for Monitoring Pesticides and Heavy Metals in North Carolina," Water Resources Research Institute, 7/73-6/74, principal investigator

"Pilot Studies on the Fate of Selected Contaminants in Public Water Supplies," Water Resources Research Institute, 7/73-6/74, co-principal investigator

Previous full-time professional experience: 8 yrs. (2 yrs. industry and 6 yrs. academic)

Member, American Chemical Society
Member, Electrochemical Society

PHILIP C. SINGER
Associate Professor
Department of Environmental Sciences and Engineering
1973

BCE	Cooper Union	Civil Engineering	1963
MS	Northwestern University	Sanitary Engineering	1965
PhD	Harvard University	Environmental Sciences & Engr.	1969

Chemical aspects of water supply and wastewater treatment, chemistry of natural waters, groundwater quality, metals and metal-organic interactions

100% (50% teaching, 50% research)

Trace Metals and Metal-Organic Interactions in Natural Waters, Ann Arbor Science Publishers, Inc., 1973

"The Solubility of Ferrous Iron in Carbonate-Bearing Waters," American Water Works Association, 62, p. 198, 1970 (with W. Stumm)

"Anerobic Control of Phosphate by Ferrous Iron," Journal Water Pollution Control Federation, 44, p. 663, 1972

"Chemical Processes for the Removal of Trace Metals from Drinking Waters," Proceedings, 16th Water Quality Conference, Trace Metals in Water Supplies, University of Illinois, 1974 (in press)

"Ozonation of Ammonia in Wastewater," accepted for publication in Water Research (with W. B. Zilli)

"Pilot Studies on the Fate of Selected Metal Contaminants in Public Water Supplies," North Carolina Water Resources Research Institute, 2/73-6/74, co-principal investigator

"Hydrogeologic Factors Involved in Predicting the Effects of Sanitary Landfill Operations on Ground Water Quality," Office of Water Resources Research, 7/71-6/73, project director

Registered professional engineer: Indiana

Previous full-time professional experience: 4 1/2 yrs. (academic)

Member, AEEP
Member, American Water Works Association; Member, Student Activities Committee (1971-date)
Member, American Chemical Society; Member, Executive Committee, Environmental Chemistry Division (1973-date)
Chairman, Environmental Chemistry Committee, Association of Environmental Engineering Professors (1974-date)

ARTHUR C. STERN
Professor of Air Hygiene
Department of Environmental Sciences and Engineering
1968

ME	Stevens Institute of Technology	Mechanical Engineering	1930
MS	Stevens Institute of Technology	Mechanical Engineering	1933

Air pollution, industrial hygiene

100% (33% teaching, 33% research, 33% administration)

Air Pollution, 3 vols, 2nd ed., Academic Press, 1968 (editor)

Fundamentals of Air Pollution, Academic Press, in press (et al.)

Methods of Air Sampling and Analysis, Intersociety Committee, American Public Health Association, 1972

"Critique of Air Quality Management Standards," US Environmental Protection Agency, 4/71-4/74, principal investigator

"The Collection, Tabulation, Codification and Analysis of the World's Air Quality Management Standards," US Environmental Protection Agency, 6/72-9/74, principal investigator

Registered professional engineer: North Carolina

Previous full-time professional experience 26 yrs. (government)

Diplomate, AAEE
Member, National Air Quality Criteria Advisory Committee, US Environmental Protection Agency
Member, Advisory Council, Electric Power Research Institute
Chairman, Triangle Universities Consortium on Air Pollution
Consultant, World Health Organization

ALVIS G. TURNER
Assistant Professor
Department of Environmental Sciences and Engineering
1969

BA	University of North Carolina-Chapel Hill	Zoology	1952
MSPH	University of North Carolina-Chapel Hill	Sanitary Science	1958
PhD	University of North Carolina-Chapel Hill	Environmental Science	1970

Management of the health facilities environment, environmental epidemiology and hospital infections, environmental sampling in hospitals, evaluation and control of community noise, analytical techniques in environmental sciences

100% (60% teaching, 30% research, 10% administration)

"The Environmental Epidemiology of Klebsiella Infections in a Thoracid Surgery Intensive Unit," Hospitals--Journal American Hospital Association, 47, p. 79, 1973 (with J. Craddock)

"The Effect of Relative Humidity on the Survival of Three Serotypes of Klebsiella," Journal Applied Bacteriology, 36, p. 497, 1973 (with Patricia Salmonsen)

"Disinfection of Immersion Tanks (Hubbard) in a Hospital Burn Unit," Archives Environmental Health, 28, p. 101, 1974 (with Mary Higgins and John Craddock)

"The Effect of Relative Humidity on the Survival of Three Klebsiella Serotypes," University Research Council, 4/71-6/74, principal investigator

"The Relationship between Hexachlorophere and Pennicillin Sensitivity of S. aureus Isolated from Human Infections," University Research Council, 11/72-11/74, principal investigator

Previous full-time professional experience: 12 yrs. (3 yrs. government and 9 yrs. industry)

Diplomate, American Intersociety Academy for the Certification of Sanitarians

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CHARLES M. WEISS
Professor of Environmental Biology and Deputy Head
Department of Environmental Sciences and Engineering
1956

BS	Rutgers University	Bacteriology/Limnology	1939
PhD	The Johns Hopkins University	Biology & Sanitary Engineering	1950

Limnology, chemistry and biology of water pollution; water quality management; environmental assessment; interaction of particulate and soluble algal nutrients

100% (40% teaching, 35% research, 25% administration)

"Water Quality Investigations, Guatemala: Lake Atitlan 1968-1970," University of North Carolina at Chapel Hill, Regional School of Sanitary Engineering-San Carlos University, Guatemala and the Instituto Geografico Nacional Guatemala, 1971

"The Carbon Budget and Total Productivity of Estuarine Oxidation Ponds Receiving Secondary Sewage Effluent," Proceedings, 2nd International Symposium for Waste Treatment Lagoons, Kansas City, Missouri, 1970 (with John Day and H. T. Odum)

"Relation of Phosphates to Eutrophication," Journal American Water Works Association, 61, 1969

"Aquatic Biology," Chapter in Water and Wastewater Engineering, Volume II: Water Purification and Wastewater Treatment (Fair, Geyer, and Okun, eds.), John Wiley and Sons, 1968

"Ecology and Man: The Dilemma of Our Technological Culture," Proceedings, 20th Southern Water Resources and Pollution Control Conference, 1972

"Algal Assay--Prediction of Potential Productivity of Fresh and Estuarine Waters," US Environmental Protection Agency, 1/72-12/73, principal investigator

"New Hope Lake Water Quality Surveillance and Limnological Studies, Kerr Reservoir," US Army Corps of Engineers, Wilmington District, 7/72-6/73, principal investigator

"Seasonal Characterization of Plankton Populations in Lakes Norman, Mountain Island, Wylie, Fishing Creek and Wateree with Particular Reference to Existing and Proposed Thermal Discharges," Duke Power Company, 2/73-2/74, principal investigator

Previous full-time professional experience: 16 yrs. (10 yrs. academic and 6 yrs. government)

Member, Joint Task Group on Biostimulation, Standard Methods for the Examination of Water and Wastewater (1972-73)
Member, National Academy of Sciences; Member, Sub-Committee on Atmospheric and Water Contaminants of Manned Spacecraft (1971)
Member, Environmental Health Review Committee, Bureau of Health Professional Education and Manpower Training, National Institutes of Health
Member, Water Pollution Control Federation; Chairman, Research Committee

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DONALD G. WILLHOIT
Associate Professor of Radiation Biophysics
Department of Environmental Sciences and Engineering
1964

AB	William Jewell College	Physics	1956
MS	University of Washington	Physics	1958
ScD	University of Pittsburgh	Radiological Health	1964

Quantitative radiation biology and dosimetry, radiological health

100% (50% teaching, 50% research)

"Implications of Dose-Rate and Dose-Fractionation," in Conference on the Estimation of Low-Level Radiation Effects in Human Populations (G. A. Sacher, ed.), ANL-7811, 1971

"Effect of Dose Rate on the Survival of Intestinal Crypt Cells in the Mouse," Radiation Research, 47, 1971 (with J. Clement)

"Survival Patterns of Mice Following Two-Dose and Three-Dose Fractionation Regimes," Radiation Research, 48, 1971 (with J. Clement)

"Comparative Effects of Radiation Exposure Regimes," US Environmental Protection Agency, 6/72-6/73, principal investigator

Certified in Health Physics--American Board of Health Physics

Previous full-time professional experience: 3 yrs. (2 yrs. industry and 1 yr. research)

AUBREY P. ALTSHULLER
Adjunct Professor
Department of Environmental Sciences and Engineering
PhD University of Cincinnati Physical Chemistry 1951
Air chemistry, ambient air and emission analysis, photochemical aspects of air pollution
100%

WARREN A. COOK
Adjunct Professor
Department of Environmental Sciences and Engineering
AB Dartmouth College Chemistry 1923
Industrial hygiene, occupational safety standards, safety engineering
100%

THOMAS D. ENGLISH
Adjunct Associate Professor
Department of Environmental Sciences and Engineering
PhD Carnegie-Mellon University Electrical Engineering 1963
Ecology and resource management, waste treatment, air monitoring networks
100%

FOREST O. MIXON
Adjunct Associate Professor
Department of Environmental Sciences and Engineering
PhD University of Delaware Chemical Engineering 1958
Water and air pollution control, desalinization processes, thermodynamics, transport processes
100%

PHILIP J. WALSH
Adjunct Assistant Professor
Department of Environmental Sciences and Engineering
PhD University of North Carolina-Chapel Hill Radiological Hygiene 1968
Public health problems of uranium mining, radiation hazards evaluation
100%

STANLEY J. WEIDENKOPF
Professor of Environmental Engineering
Department of Environmental Sciences and Engineering
DrEngr The Johns Hopkins University Sanitary Engineering 1957
Inactivation of virus by chlorine, environmental engineering, management
100%

WILLIAM E. WILSON, JR.
Adjunct Professor
Department of Environmental Sciences and Engineering
PhD Purdue University Physical Chemistry 1957
Planning, supervising and performing research in atmospheric chemistry, chemical kinetics, combustion and molecular spectroscopy
100%

LEONARD J. GOLDWATER
Visiting Professor of Occupational Medicine
Department of Community Health Sciences, Duke University
MD New York University Medicine 1928
Hematology, occupational medicine, mercury studies, industrial hygiene

MARIO C. BATTIGELLI
Associate Professor of Occupational Health
Department of Preventive Medicine
School of Medicine
MD University of Florence Medicine 1951
Industrial medicine, applied physiology and toxicology
50%

MILTON S. HEATH, JR.
Professor of Law and Government
Institute of Government
LLB Columbia University Law 1952
Natural resource law, regulatory aspects of pollution control programs
50%

DAVID H. HOWELLS
Professor, Department of Biological and Agricultural Engineering
North Carolina State University
MS Massachusetts Institute of Technology Sanitary Engineering 1955
Water resources conservation and management
100%

MAYNARD M. HUFSCHMIDT
Professor of Natural Resources and Regional Planning
Department of City and Regional Planning
DPA Harvard University Public Administration 1964
Water resource planning in the urban-metropolitan context, regional development policy, environmental planning
100%

BENJAMIN J. KORGEN
Assistant Professor
Department of Geology
PhD Oregon State University Physical Oceanography 1969
Physical oceanography, heat flow geophysics
50%

DAVID H. MOREAU
Associate Professor of Systems Analysis
Department of City and Regional Planning
PhD Harvard University Water Resources 1967
Environmental systems analysis
100%

ARTHUR W. WALTNER
Professor of Physics
North Carolina State University
PhD University of North Carolina Physics 1949
Experimental nuclear physics, nuclear reactor instrumentation, radiological hygiene
50%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Envir. Sciences	Master's	64	3	72	2	74	2	86	5	80	6	ENROLLMENT
& Engineering	Doctoral	21	-	23	1	24	1	27	1	22	1	
Envir. Sciences	Master's	34		35		38		37		-		GRADUATES
& Engineering	Doctoral	7		8		5		5		-		
Envir. Sciences	Master's	7										NON-US NATIONALS
& Engineering	Doctoral	5										

	Master's	Doctoral	
EPA traineeships & scholarships	28	0	SUPPORT
Other traineeships	18	5	
University fellowships	2	1	
Research assistantship	31	10	
Foundation support	1	0	
Government employer	6	1	
Armed Forces	4	0	
Industrial employer	1	0	
Self supported	7	4	
Consulting	9	8	EMPLOYMENT (%)
Industry	11	0	
Federal government	13	15	
Other government	15	8	
Academic	4	50	
Foundation	0	4	
Further study	17	0	
Military	14	4	
University research (non-faculty)	9	11	
Unknown	8	0	

Facilities

The proximity of the Department to the Research Triangle Park offers opportunities to our students for research and study with government and private research facilities including the National Environmental Research Center of the US Environmental Protection Agency, the Institute of Environmental Health Sciences, and the Research Triangle Institute.

A major departmental research facility is the Wastewater Research Center. This center has full-scale, pilot-scale, and bench-scale facilities for research in all aspects of wastewater treatment and water pollution research. Special laboratories have also been provided to support environmental studies being conducted on the rubber industry including facilities for gas chromatography, infra red spectroscopy and conventional wet chemical methods of analysis using spectrophotometry and specific ion electrodes. Field equipment includes octave band analyzers and impact noise meters, high volume multi-orifice cascade impactor, and a piezo-electric particle mass monitor. A new photochemical research laboratory has also been recently constructed. This is a 12,000 cubic foot outdoor reaction chamber with associated laboratory sampling facility located on a rural site. The facility consists of automatic air monitoring instruments, meteorological instrumentation, a data acquisition/computer system and laboratory space. Studies on surface water quality of lakes, rivers and estuaries are possible through a completely equipped limnological laboratory including a 17 food boat and trailer. Numerous other teaching and research laboratories are located in the Department.

North Carolina State University

Raleigh, North Carolina

School of Engineering
Department of Civil Engineering

Civil Engineering

ECPD Accredited--Civil Engineering

Dr. Charles Smallwood
Professor of Civil Engineering
416 Mann Hall
North Carolina State University
Raleigh, NC 27607
(919) 737-2333

March 1974

A number of areas of concentration are possible under the umbrella of the Civil Engineering Department including hydraulics, ocean engineering, water supply and pollution control, and industrial waste control and abatement. Majors in chemical engineering, biological and agricultural engineering, textile chemistry, wood and paper science, and food science participate in the program in industrial waste control and abatement. There is also an interdisciplinary minor available to social science majors in water resources. Engineers and biological scientists have a minor in air conservation available.

North Carolina State University is a land-grant institution with an enrollment of approximately 14,000. Close association is maintained with Duke University in Durham and the University of North Carolina at Chapel Hill, as well as with the Research Triangle Institute.

The books and facilities of the research libraries of the Triad Universities are readily available to students enrolled at any of the Triad Institutions. In addition, North Carolina State University has on campus terminals for the Triangle Universities Computation Center housed in the Research Triangle Park. North Carolina State University tuition and fees are less than $2,000 per year for full-time students.

Raleigh is a beautiful community of 150,000 people and provides a wide variety of housing for those students who do not wish to live on campus.

Admission Requirements

(a) 3.0/4 undergraduate GPA in area of major.

(b) GRE is desirable if applicants desire fellowships or scholarships. Advanced GRE test is also desirable. No policy has been established on minimum score or combined scores.

(c) Provisional admission may be granted to applicants who lack undergraduate work considered essential for graduate study in the major field. Graduates from nonaccredited institutions may be granted provisional admission when their academic records warrant. In both cases, students are required to make up such deficiencies.

(d) TOEFL scores are required for foreign students but would not necessarily exclude the student.

(e) Majors are required to have background that includes ECPD math, science, and engineering science to qualify for engineering degrees. Majors in other areas and in social sciences who enroll for minors are evaluated individually by those departments.

(f) Make-up courses or prerequisites required for nonengineers include: ECPD math, science, and engineering science.

(g) Applicants must have two letters of recommendation submitted.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	30S	Yes	No	-	12
MCE	30S	No	No	-	12
PhD	a	Yes	1	12 mos.	36

[a] The PhD degree is not granted on the basis of successful completion of a given amount of course work, but rather upon the demonstration by a candidate of a comprehensive knowledge and high attainment in scholarship and research in a specialized field of study. These are determined by the quality of the dissertation which the candidate prepares to report the results of original investigations and by passing successfully a series of rigorous and comprehensive examinations on the special and related fields of study.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 370	Elements of Environmental Hygiene	Johnston	3S	S'74	9
CE 383	Water Resources Engineering I	Smallwood Amein	4S	S'74	77
CE 472	Air Quality Management	Shearer	3S	F'73	12
CE 484	Water Resources Engineering II	Smallwood Amein	3S	S'74	11
CE 486	Measurements of Water Quality	Colston	3S	S'74	14
CE 514	Municipal Engineering Projects	Babcock	3S	S'74	17
CE 570	Sanitary Microbiology	Humenik	3S	S'74	9
CE 571	Theory of Water & Waste Treatment	Galler	3S	F'73	22

CE 572	Unit Operations & Processes in Wastes Engineering	Colston	3S	S'74	9
CE 573	Analysis of Water & Wastes	Colston	3S	F'73	9
CE 574	Radioactive Waste Disposal	Smallwood	3S	S'73	48
CE 575	Civil Engineering Systems	Galler	3S	S'74	7
CE 576	Atmospheric Pollution	Shearer	3S	S'74	6
CE 580	Flow in Open Channels	Amein	3S	S'74	7
CE 581	Intro. to Oceanographic Engineering	Machemehl	3S	S'74	7
CE 591	Civil Engineering Seminar	Howells	1S	F'73	16
CE 598	Civil Engineering Projects	Smallwood	1-6S	S'74	1
CE 643	Hydraulics of Ground Water (to be changed to CE 543)	Kashef	3S	S'72	20
CE 671	Adv. Water Supply & Wastewater Disposal	Galler Smallwood	4S	F'73	7
CE 672	Adv. Water & Waste Treatment	Galler	4S	S'74	5
CE 673	Industrial Water Supply & Waste Disposal	Smallwood	3S	F'73	11
CE 674	Stream Sanitation	Smallwood	3S	S'74	12
CE 698	Special Topics in Civil Engineering	Staff	1-3S	-	-
CE 699	Civil Engineering Research	Staff	Varies	S'74	1
EC 436	Environmental Economics	Carlson	3S	S'74	-
EC 515	Economics of Water Resources Develop.	Seagraves	3S	S'73	20
TC 401	Sources & Control of Pollution from the Textile Industry	Bryan	3S	S'74	26
WPS 525	Pollution Abatement in Forest Products Industries	McKean	3S	S'74	14

Faculty

MICHAEL AMEIN
Professor
Civil Engineering Department
1960

BSCE	Stanford University	Civil Engineering	1952
MSCE	Cornell University	Civil Engineering	1954
PhD	Cornell University	Civil Engineering	1955

Hydraulics, oceanography, computer applications in stream flow analysis

100% (60% teaching, 40% research)

"Implicit Flood Routing in Natural Channels," Journal Hydraulics Division, American Society of Civil Engineers, 96, HY12, pp. 2481-2500, December 1970 (with C. S. Fang)

"Coastal Erosion in North Carolina," Journal Waterways and Harbors Division, American Society of Civil Engineers, May 1970 (with L. J. Langfelder and D. B. Stafford)

"Study of Roadside Drainage Channels in North Carolina," Final Report, Highway Research Program, Project ERD110-68-4, North Carolina State University, April 1970

"Study of Circulation in Pamlico Sound," North Carolina Board of Science and Technology, 7/69-12/71, principal investigator

"Development of Operational Programs for Numerical Flood Routing in Rivers and Reservoirs," US Department of Commerce, 7/70-12/72, principal investigator

"Circulation and Diffusion in Estuarine Waters and Water Flow through Coastal Inlets," National Science Foundation (Sea Grant), co-principal investigator

Previous full-time professional experience: 5 yrs. (consulting)

Reviewer of Papers for Journal Hydraulics Division, American Society of Civil Engineers (1971-72)
Reviewer of Papers for Water Resources Research, American Geophysical Union (1971-72)

CARL E. BRYAN
Research Associate
Textile Chemistry Department
1968

BA	University of Mississippi	-	1937
PhD	University of Minnesota	-	1942

Research pollution abatement and control

100% (30% teaching, 70% research)

"Soil-Resistant Acrylic Fibers," US Application, 1971 (et al.)

"Water Pollution Reduction through Recovery of Desizing Wastes," US Environmental Protection Agency, 10/69-1/71, project leader

"Recovery and Reuse of Synthetic Size from Textile Finishing Wastewaters," US Environmental Protection Agency, 1/72-12/72, project leader

"A Literature Survey of Colored Wastes," American Dye Manufacturers Institute, 2/71-12/71, project leader

Member, American Chemical Society
Member, American Association of Textile Chemists and Colorists
Member, American Association for the Advancement of Science

N. V. COLSTON, JR.
Assistant Professor
Civil Engineering Department
1968

BS	Virginia Polytechnic Institute	Civil Engineering	1964
MS	Virginia Polytechnic Institute	Civil Engineering	1966
PhD	Virginia Polytechnic Institute	Civil Engineering	1968

Theory and design of unit operations employed in water and waste treatment, hydrologic phenomenon, computer applications in sanitary engineering, storm water quality and treatment

100% (40% teaching, 60% research)

"Wastewater Characterization of Conventional Sweet Potato Processing," Journal Water Pollution Control Federation, accepted for publication, October 1972

"Waste Control in the Processing of Sweet Potatoes," Proceedings, 3rd National Symposium on Food Processing Wastes, New Orleans, March 1972 (with C. Smallwood, Jr.)

"A Technique of Generating a Synthetic Flow Record to Estimate the Variability of Dependable Flows for a Fixed Reservoir Capacity," Water Resources Research, 6, 1, February 1970

"Waste Control and Abatement in the Processing of Sweet Potatoes," US Environmental Protection Agency, 4/1/73-8/1/73, co-investigator

"Characterization and Treatment of Urban Land Runoff," Federal Water Pollution Control Administration, 7/1/71-6/30/73, principal investigator

"Pilot Study of the Relationship between Trace Metals in Dustfall and Urban Runoff in Durham, North Carolina," Triangle Universities Consortium on Air Pollution, 7/1/71-6/30/73, co-principal investigator

Registered professional engineer: North Carolina and Virginia

Member, American Society of Civil Engineers; Member, Sanitary Engineering Division Committee on Sewerage and Sewerage Treatment
Member, Water Pollution Control Federation
Member, American Society of Engineering Education

WILLIAM S. GALLER
Associate Professor
Civil Engineering Department
1964

BS	Illinois Institute of Technology	Chemical Engineering	1951
MS	Illinois Institute of Technology	Sanitary Engineering	1961
PhD	Northwestern University	Civil Engineering	1965

Theory and design of unit operations and processes in water and waste treatment, analysis of water and wastes, application of systems analysis to sanitary engineering

100% (80% teaching, 20% research)

"Design Optimization for Biological Filter Models," presented at the 13th Inter-American Congress of Sanitary Engineers, Asuncion, Paraguay, August 1972 (to be published in Journal of Inter-American Association of Sanitary Engineers) (with H. B. Gotaas)

"High Rate Poultry Manure Composting with Sawdust," Livestock Waste Management and Pollution Abatement, Proceedings, International Symposium on Livestock Wastes, American Society of Agricultural Engineers, pp. 159-162, 1971 (with C. B. Davey)

"Clean Water: Affluence, Influence, Effluents," Report, 1971 Summer Faculty Fellowship Program in Engineering Systems Design, NASA Contract, NGT 47-003-028, NASA Langley Research Center and Old Dominion University, Hampton, Virginia, 1971 (coauthor, Chapters 3 and 5)

Registered professional engineer: North Carolina and Illinois

Previous full-time professional experience: 10 yrs. (government)

Reviewer, Journal American Water Resources Association (1971-72)
Member, Sigma Xi; Member, Membership Committee, North Carolina State Chapter (1971-72)
Member, American Society of Civil Engineers; Member, Solid Waste Management Committee, Sanitary Engineering Division (1971-72)

J. F. HUMENIK
Assistant Professor
Biological and Agricultural Engineering and Civil Engineering Departments
1969

BSCE	Ohio State University	Sanitary Engineering	1963
MS	Ohio State University	Sanitary Engineering	1966
PhD	Ohio State University	Sanitary Engineering	1969

Biological processes, agricultural waste disposal

100% (80% teaching, 20% research)

"Evaluation of Methods for the Analysis of Physical, Chemical, and Biochemical Properties of Animal Waste Water," American Society of Agricultural Engineers Workshop, Chicago, December 1972

"Swine Waste Characterization and Evaluation of Animal Waste Treatment Alternatives," Water Resources Report No. 61, Water Resources Research Institute, June 1972

"Evaluation of Swine Waste Treatment Alternatives," Proceedings, Cornell University Conference on Agricultural Waste Management, 1972 (et al.)

"Alternative Animal Waste Pretreatment--Land Disposal Systems," US Department of Agriculture-CSRS, 6/1/72-5/30/73, co-project leader

"Criteria for Swine Waste Treatment Systems," US Environmental Protection Agency, 1/15/73-1/15/74, project director

"Overland Flow Poultry Manure Treatment System," Water Resources Research Institute Matching Grants Program, 7/1/73-7/1/75, co-principal investigator

Member, American Society of Civil Engineers
Member, American Society of Agricultural Engineers

A. I. KASHEF
Professor
Civil Engineering Department
1962

SB	Cairo University (Egypt)	Civil Engineering	1940
MSc	University of Illinois	Structural Engineering	1948
PhD	Purdue University	Civil Engineering	1951

Hydraulics of ground water, salt water intrusion in coastal acquifers, foundation engineering

100% (60% teaching, 40% research)

"Overpumped Artesian Wells among a Well Group," Water Resources Bulletin, Journal American Water Resources Association, 7, 5, pp. 981-990, 1971

"What Do We Know about Salt Water Intrusion?" Water Resources Bulletin, Journal American Water Resources Association, 8, 1, pp. 282-293, 1972

"Pollution of Ground Water by Salt Invasion," Ground Water Pollution, published by the Underwater Research Institute, St. Louis, Missouri

"Title II Project," Office of Water Resources Research, 7/72-6/74, principal investigator

Registered professional engineer: Virginia

Previous full-time professional experience: 6 1/2 yrs. (5 1/2 yrs. government and 1 yr. consulting)

Reviewer, Ground Water Journal (1971-72)
Member, American Water Resources Association; Member, Publication Committee (1971-72); Editor, Water Resources Bulletin, Journal American Water Resources Association

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DAVID B. MARSLAND
Associate Professor and Director of Air Programs
Chemical Engineering Department
1961

BChE	Cornell University	Chemical Engineering	1951
PhD	Cornell University	Chemical Engineering	1958

Polymer technology, numerical analysis, environmental control

100% (70% teaching, 30% research)

"Graduate Training in Air Conservation," US Environmental Protection Agency, 1970-date, program director

Member, American Institute of Chemical Engineers; Member, Education Committee of Environmental Division

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WILLIAM T. MCKEAN, JR.
Associate Professor
Wood and Paper Science Department
1970

BS	University of Colorado	Chemical Engineering	1960
PhD	University of Washington	Chemical Engineering	1968

Problems of food and forest products industries

100% (70% research, 30% teaching)

"Modern Practices in Mint Harvesting," Food Engineering, in press

"Sensory Evaluation of Peppermint Oil Containing Varying Amounts of Menthofuran," Journal Food Science, in press

Previous full-time professional experience: 7 yrs. (research)

Member, Technical Association of the Pulp and Paper Industry
Member, Institute of Food Technologists

JAMES A. SEAGRAVES
Professor
Economics Department
1956

BA	Reed College (Portland, Oregon)	Economics	1951
MS	Iowa State University	Agricultural Economics	1952
PhD	Iowa State University	Agricultural Economics	1956

Resource prices and public policy and industrial wastes surcharges

100% (70% research, 30% teaching)

CHARLES SMALLWOOD, JR.
Professor
Civil Engineering Department
1950

BSCE	Case Institute of Technology	Civil Engineering	1942
SM	Harvard University	Civil Engineering	1948

Water supply and wastewater disposal, stream sanitation, industrial wastewater disposal

100% (60% teaching, 20% research, 20% administration)

"Waste Control in the Processing of Sweet Potatoes," Proceedings, 3rd National Symposium on Food Processing Wastes, New Orleans, March 1972 (with N. V. Colston)

"Biology and Water Pollution Control," Book Review in Journal American Water Resources Association, pp. 1099-1100, October 1971

"Urban Erosion as a Source of Pollution," Proceedings, 20th Southern Water Resources and Pollution Control Conference, University of North Carolina-Chapel Hill, pp. 52-64, April 1971 (with H. R. Malcom, Jr.)

"Waste Control and Abatement in the Processing of Sweet Potatoes," US Environmental Protection Agency, 4/1/73-8/1/73, co-investigator

"Training Grant in Water Supply and Pollution Control," US Environmental Protection Agency, 7/1/69-6/30/74, program director

"Training Grant in Industrial Waste Control and Abatement," US Environmental Protection Agency, 7/1/68-6/30/73, program director

Registered professional engineer: North Carolina

Previous full-time professional experience: 2 yrs.

Member, American Society of Civil Engineers; Member, Industrial Waste Committee, Environmental Engineering Division (1971-date)
Director, Federation of Water Pollution Control Association (1973)
Member, North Carolina Board of Certification for Water Facility Operators
Chairman, Survey Committee, Association of Boards of Certification (1972-date)

JERRY L. MACHEMEHL
Assistant Professor
Civil Engineering Department

PhD	Texas A & M University	Civil Engineering	1962

Hydraulic and marine engineering and ocean disposal
30%

DAVID H. HOWELLS Professor and Director Water Resources Research Institute			
MS	Massachusetts Institute of Technology	Civil Engineering	1955
Water resources management 100%			

DAVID S. SHEARER Adjunct Associate Professor Civil Engineering Department			
PhD	University of Wisconsin	Civil Engineering	1962
Air pollution 25%			

Students

		69-70	70-71	71-72	72-73	73-74	
		FT PT	FT PT	FT PT	FT PT	FT PT	
Civil Engineering	Master's	19	45	36	38	42	ENROLLMENT
	Doctoral	8	11	13	14	17	
Civil Engineering	Master's	6	21	17	14	12	GRADUATES
	Doctoral	3	5	3	8	4	
Civil Engineering	Master's	0	NON-US NATIONALS				
	Doctoral	0					

	Master's	Doctoral	
EPA traineeship	12	3	SUPPORT
EPA doctoral fellowship	0	1	
Research assistantship	9	6	
Teaching assistantship	3	3	
Government employer	4	4	
Self-supported	3	0	

	Master's & Doctoral	
Consulting	35	EMPLOYMENT (%)
Industry	35	
Government	20	
Military	5	
Further study	5	

Facilities

The sanitary chemistry and biology laboratories occupy over 2000 square feet. Special areas are devoted to a walk-in BOD room, a biological preparations laboratory, and three individual research laboratories. A nuclear laboratory designed for low-level tracer studies occupies 500 square feet. Counting equipment includes Geiger, gas flow, neutron and scintillation crystal detectors and accompanying scalers, amplifiers, and discriminators.

The Civil Engineering Department occupies Mann Hall, a new air-conditioned building, located in the approximate center of the campus.

The D. H. Hill Library contains over 600,000 volumes in its collection and is devoted primarily to technological and scientific material. Computer facilities are excellent and are based around an IBM System 370 Model 165 computer. A central machine shop is available and can fabricate research equipment of the highest degree of complexity.

Northeastern University

Boston, Massachusetts

College of Engineering
Department of Civil Engineering

Environmental Engineering and Science

Dr. John J. Cochrane, Chairman
Graduate Environmental Committee
208 Botolph Building
Northeastern University
Boston, MA 02115
(617) 437-2444

May 1973

The program educates students in the professional practice of environmental engineering and science. Students may take the program under one of three plans: (1) cooperative work/study (10 students); (2) continuous full-time (12 students); (3) part-time evenings (185 students). The course work is normally comprised of core courses in water and waste treatment including laboratory (40%); a meaningful sequence of courses in water and wastewater engineering, water resources planning, environmental engineering and science or air pollution control (30%); a Master's report (10%) or thesis (20%); and electives (10% or 20%). The degrees currently offered are MSCE, MS, and PhD.

Admission Requirements

(a) 2.5/4 undergraduate GPA for MS and MSCE.

(c) GPA requirements can be waived in certain circumstances.

(d) GRE is required for all foreign students.

(e) Civil engineering, chemical engineering, mechanical engineering, chemistry, and biology majors are admissible without extensive prerequisites.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	40Q	Optional	-	-	10-40
MSCE	40Q	Optional	-	-	10-40
PhD	80Q	Yes	Yes	12 mo.	24-48

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
1.901	Hydraulics I	Branagan	2Q	A'72	27
1.902	Hydraulics II	Branagan	2Q	W'73	25
1.903	Hydraulics III	Branagan	3Q	S'73	24
1.904	Hydraulics	Branagan	4Q	W'73	13
1.905	Water Resources Planning I	Horn	2Q	A'72	28
1.906	Water Resources Planning II	Horn	2Q	W'73	28
1.907	Water Resources Planning III	Horn	2Q	S'73	26
1.910	Water & Waste Treatment I	Meserve Cochrane	2Q	A'72	52
1.911	Water & Waste Treatment II	Meserve Cochrane	2Q	W'73	48
1.912	Water & Waste Treatment III	Meserve Cochrane	2Q	S'73	45
1.913	Industrial Waste Disposal	Blanc	2Q	S'73	12
1.920	Environmental Chemistry I	Wei O'Shaughnessy	2Q	A'72	55
1.921	Environmental Chemistry II	Wei O'Shaughnessy	2Q	W'73	50
1.922	Environmental Bacteriology	Wei O'Shaughnessy	2Q	S'73	46
1.923	Environmental Chemistry	Cochrane	4Q	A'72	13
1.930	Environmental Analysis I	O'Shaughnessy Hawkes Potter	2Q	W'73	48
1.931	Environmental Analysis II	O'Shaughnessy Hawkes Potter	2Q	W'73	46
1.933	Environmental Analysis III	Wei O'Shaughnessy	4Q	A'72	18

1.935	Envir. Engr.--Unit Operations	Fillos	2Q	W'72	12
1.936	Envir. Engr.--Unit Operations	Fillos	2Q	S'73	12
1.938	Public Health Engineering Survey	Parker	2Q	A'72	21
1.945	Solid Waste Management	Blanc	2Q	A'72	32
1.946	Waste Reclamation	-	-	New	-
1.947	Incineration	-	-	New	-
1.948	Solid Waste Laboratory	-	-	New	-
1.950	Air Pollution	Gregory	2Q	A'72	18
1.951	Radiological Health Engineering	Parker	2Q	W'73	15
1.952	Industrial Hygiene	Gregory	2Q	S'73	13
1.953	Environmental Microbiology	Gregory	2Q	S'71	8
1.954	Stream Sanitation	Blanc	2Q	A'72	10
1.956	Air Pollution Engineering	Gregory	2Q	A'72	17
1.957	Air Pollution Science	Gregory	2Q	W'73	15
1.960	Hydraulic Structures I	Brodfelt	2Q	A'72	27
1.961	Hydraulic Structures II	Brodfelt	2Q	W'73	26
1.962	Hydraulic Structures III	Brodfelt	2Q	S'73	24
1.970	Design of Environmental Systems	Cochrane	4Q	S'73	9
1.980	Envir. Planning & Management	Newman	2Q	A'73	-
1.985	Environmental Protection	Smith	2Q	W'74	-
1.991	Thesis (Master's)	-	-	-	-
1.992	Special Topics	-	-	-	-
1.993	Master's Report	-	-	-	-
1.994	Seminar--Environmental Engineering	Cochrane	2Q	W'73	8
1.996	Seminar--Environmental Health	Gregory	2Q	S'73	5
1.997	Thesis (PhD)	-	-	-	-

1.910, 1.911, 1.912, 1.921, 1.920, 1.922, 1.930, 1.931, and 1.993 or 1.991 are required for all environmental engineering and science students

1.935, 1.936, 1.907, 1.954, and 1.994 are required for all water and wastewater engineering students.

Students taking the water resources planning option must take 1.905, 1.906, 1.907, 1.960, 1.961, 1.962, 1.901, 1.902, and 1.903.

The environmental health engineering and science option requires 1.940, 1.950, 1.951, 1.952, 1.996, and 1.955.

Students choosing the air pollution engineering option must take 1.800, 1.950, 1.996, 1.955, and 1.957.

Faculty

ROBERT L. MESERVE
Associate Professor
Department of Civil Engineering
1962

BSCE	Northeastern University	Civil Engineering	1951
MSCE	Northeastern University	Civil Engineering	1962

Fresh water quality, fresh water algae, eutrophication-limnology, engineering and the humanities, water and wastewater treatment

100% (teaching and administration)

"Beyond the Code of Professional Ethics," Journal Boston Society of Civil Engineers, October 1972

"Bridging the Generation Gap," American Association of Cost Engineers Bulletin, February 1970

"A Human Approach to Engineering," Journal Engineering Studies of New England, Part I, November 1969; Part II, December 1969

Water and Its Impurities, 2nd ed., to be published by Dowden, Hutchinson and Ross, 1973 (with the late T. R. Camp)

Registered professional engineer: Massachusetts

Previous full-time professional experience: 11 yrs. (9 yrs. consulting and 2 yrs. government)

Member, Designer Selection Board, Commonwealth of Massachusetts (1966-69)
Member, Planning Board, Town of Wilmington, Massachusetts (1955)
Member, Boston Society of Civil Engineers; Journal Editor (1963-65); Chairman, Sanitary Section (1966-67); Chairman, Sanitary Section Award Committee (1970-date)
Member, Engineering Societies of New England; Member, Executive Committee (1962-69), Journal Editor (2 terms); President (1966-67)

JOHN J. COCHRANE
Director, EPA Training Grant Program and
Associate Professor
Department of Civil Engineering
1965

BSCE	Northeastern University	Civil Engineering	1960
MS	Rensselaer Polytechnic Institute	Environmental Engineering	1962
PhD	Rensselaer Polytechnic Institute	Environmental Engineering	1965

Treatment systems for water and wastewater, environmental chemistry, filtration, flocculation

100% (60% teaching, 20% research, 20% administration)

"The Design of a Collection System and an Advanced Wastewater Treatment System," Town of Sherburne, Vermont, August 1972

"Water Resources Potential of an Urban Estuary," Massachusetts Water Resources Research Center, July 1970 (with C. J. Gregory and G. L. Aronson)

"Solid Waste Management," Department of Commerce and Development, Commonwealth of Massachusetts, July 1967 (with A. S. Goodman)

"The Philosophy of Co-operative Education in International Water Training Programs," Proceedings, International Water for Peace Conference, May 1967

Registered professional engineer: Massachusetts, New York, and Vermont

Member, American Water Works Association (1965-date)
Member, Water Pollution Control Federation (1965-date)
Member, Boston Society of Civil Engineers (1960-date); Chairman, Environmental Section (1972-73)
Technical Advisor, Planning Commission, Town of Sherburne, Vermont (1973)
Member, Sigma Xi

CONSTANTINE J. GREGORY
Associate Professor
Department of Civil Engineering
1967

AB	Northeastern University	Biology	1962
MS	Rutgers University	Environmental Science	1964
PhD	Rutgers University	Environmental Science	1968

Air pollution science, air pollution engineering, air sampling and analysis, industrial hygiene

100% (80% teaching, 20% research)

"Notes on the Growth of Ulva as a Function of Ammonia Nitrogen," Phytologia, 18, 65, 1969 (with T. Waite)

"Parameters Affecting the Growth of Ulva Latissima in a Polluted Estuary," Proceedings, The Annual Northeastern Regional Anti-Pollution Conference, University of Rhode Island, 1969 (with T. Waite)

"Water Resources Potential of an Urban Estuary," (Saugus River, Pines River, and Lynn Harbor Complex), Final Report, US Department of the Interior, Office of Water Resources Research (A-028-Mass), 1970 (with G. L. Aronson and J. J. Cochrane)

"Mechanism of Sulfur Dioxide Absorption by Natural and Synthetic Textile Fibers," Journal Air Pollution Control Association, 20, 471, 1970 (with R. M. Manganelli)

"A Comparison of the Size Distribution of Particulates Emitted from Air, Mechanical and Steam Atomized Oil Fired Burners," Journal Air Pollution Control Association, 22, 1972 (with F. J. McGarry)

"Environmental Health Traineeship," US Public Health Service, 1971-date, director

"Environmental Health Engineering and Science Curriculum Development Grant," US Public Health Service, 1971-date, director

"Air Pollution and Radiological Health," US Public Health Service Development Grant, 1967-71, program coordinator

Member, Board of Directors of the New England Consortium on Air Pollution
Member, American Chemical Society
Member, Air Pollution Control Association
Member, American Association for the Advancement of Science

FREDERIC C. BLANC
Assistant Professor
Department of Civil Engineering
1969

BSCE	City College (New York)	Civil Engineering	1962
MSCE	New York University	Civil Engineering	1966
PhD	New York University	Civil Engineering	1969

Water and wastewater treatment, industrial waste treatment, environmental chemistry, stream and estuary analysis

100% (80% teaching, 20% research)

"Electrode Potentials and Electrolytic Control in the Anaerobic Digestion Process," Proceedings, 24th Annual Purdue Industrial Waste Conference, 1969 (with A. H. Molof)

"Electrode Potential Monitoring and Electrolytic Control of Anaerobic Digestion," accepted for publication in 1973 by Journal Water Pollution Control Federation (with A. H. Molof)

"Electrolytic Control of Anaerobic Waste Treatment Processes," Proceedings, 28th Annual Purdue Industrial Waste Conference, May 1973

"Leachate Treatment by Coagulation and Precipitation," accepted for publication in 1973 by Environmental Engineering Journal, American Society of Civil Engineers (with R. J. Thornton)

"Determination of Design Criteria for Electrolytic pH Control of the Anaerobic Digestion Process," National Science Foundation, 4/70-3/72, principal investigator

Registered professional engineer: New York, Connecticut, Massachusetts, and Vermont

Previous full-time professional experience: 4 yrs. (2 1/2 yrs. government, 1 yr. consulting, and 1/2 yr. industry)

Member, American Society of Civil Engineers (1962-date)
Member, New England Water Pollution Control Association (1972-date)

DENNIS R. HORN
Assistant Professor
Department of Civil Engineering
1969

BS	Princeton University	Geological Engineering	1964
MS	Johns Hopkins University	Environmental Engineering	1965
PhD Candidate	Johns Hopkins University	-	Present

Water resources planning, hydrology, storm runoff, geology

100% (teaching)

"The Effect of Basin Characteristics on the Outlet Hydrograph from a 9-Acre Impervious Drainage Basin," Technical Report No. 6 of the Storm Drainage Research Project, The Johns Hopkins University, January 1967

"Synthesis of the Inlet Hydrograph from Small Pervious and Combination Pervious-Impervious Drainage Areas," Technical Report No. 7 of the Storm Drainage Research Project, The Johns Hopkins University, November 1967 (with N. Dee)

IRVINE W. WEI
Assistant Professor
Department of Civil Engineering
1971

BSCE	National Taiwan University	Civil Engineering	1963
MS	University of Illinois	Sanitary Engineering	1966
SM	Harvard University	Environmental Engineering	1970
PhD	Harvard University	Environmental Engineering	1972

Environmental chemistry, chemical kinetics, chlorination

100% (teaching)

"Removal of Nematodes by Rapid Sand Filtration," Journal Sanitary Engineering Division, American Society of Civil Engineers, 95, SA1, Proc. Paper 6384, pp. 1-16, February 1969 (with R. S. Engelbrecht and J. H. Austin)

"Chlorine-Ammonia Breakpoint Reactions: Model Mechanism and Computer Simulation," presented before the Division of Water, Air and Waste Chemistry, at 157th National Meeting of the American Chemical Society, Minneapolis, Minnesota, April 1969 (with J. C. Morris)

"Dynamics of Breakpoint Chlorination," presented at Division of Water, Air and Waste Chemistry, 165th National Meeting of American Chemical Society, Dallas, Texas, April 1973; to be published in Chemistry of Water Supply, Treatment and Distribution, Ann Arbor Science Publishers, Inc., Michigan, 1973 (with J. C. Morris)

Previous full-time professional experience: 1 yr. (consulting)

Member, American Chemical Society, Division of Environmental Chemistry

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JAMES C. O'SHAUGHNESSY
Assistant Professor
Department of Civil Engineering
1972

BS	University of New Hampshire	Civil Engineering	1965
MS	Pennsylvania State University	Sanitary Engineering	1970
PhD	Pennsylvania State University	Civil Engineering	1973

Environmental chemistry and microbiology, unit operations, eutrophication, waste sludge treatment

"Soluble Phosphorus Removal in the Activated Sludge Process: Part I, Sludge Digestion Study," Water Pollution Control Research Series, Environmental Protection Agency, Report for Project #17010 EIP, October 1971 (et al.)

Registered professional engineer: Pennsylvania and New Hampshire

Previous full-time professional experience: 3 yrs. (government)

Associate Member, American Society of Civil Engineers
Member, Water Pollution Control Association (Pennsylvania and New England)

LYLE E. BRANAGAN
Assistant Professor
Department of Civil Engineering
1967

ScB	Brown University	Civil Engineering	1950
ScM	Harvard University	Civil Engineering	1954

Hydraulics

100% (teaching)

Registered professional engineer: New York

Previous full-time professional experience: 16 yrs. (consulting)

Member, American Society of Civil Engineers; Past Student Advisor
Member, Boston Society of Civil Engineers; Member, Membership Committee
Member, US Committee on Large Dams

Students

	68-69		69-70		70-71		71-72		72-73		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master's	15	127	14	120	18	165	19	170	21	185	ENROLLMENT
Doctoral	-	-	-	-	-	-	0	0	1	0	

	Master's	
EPA traineeship	8	
HEW traineeship	3	
Research assistantship	1	SUPPORT
Other University support	2	
Co-op employer	4	
Self-supported	3	

Consulting	30	
Federal government	25	
Other government	25	EMPLOYMENT (%)
Further study	5	
Military	15	

Facilities

The total area of the environmental laboratories is 5,500 square feet. Modern analytical and control equipment is available for instruction and research in physical, chemical, and biological aspects of water, wastewater, and air. Department shop facilities are available for model and pilot plant construction. Adequate library holdings exist within the department and can be augmented by arrangements with neighboring schools and consulting offices. Field sampling equipment for solid and liquid wastes as well as atmospheric sampling is regularly used in several sampling areas.

A terminal in the department connected to the University's large electronic digital computer regularly services the needs of the program. Major elements of analytical equipment in the environmental laboratory include: total organic carbon analyzer (Dorhma), atomic absorption spectrophotometer (Perkin Elmer), visible-ultraviolet spectrophotometer (Perkin Elmer), fluorescence spectrophotometer (Perkin Elmer), gas chromatograph with four different detectors, numerous spectrophotometers, and scale models of many unit operations.

Northwestern University

Evanston, Illinois

Department of Civil Engineering
The Technological Institute

Environmental Health Engineering

ECPD Accredited--Environmental Health Engineering

Dr. J. E. Quon, Coordinator
Environmental Health Engineering
Department of Civil Engineering
The Technological Institute
Northwestern University
Evanston, IL 60201
(312) 492-3257

February 1974

Research and training in engineering, science, and mathematics form the core of graduate study in environmental health engineering at Northwestern University. The environmental health engineer of the future will need to acquire the capacity to manage overall environmental systems as well as substantive knowledge to deal with special problems as they arise. The graduate program in environmental health engineering provides an integrated engineering and scientific basis for the improvement and management of the quality of our environment. Such a capability depends upon the continual development of new information on the interactions of man and his environment, the development of new technology for the transformation of air, liquid, and solid waste materials into a form compatible with man and with the environment, and upon the conception and implementation of plans and strategies using existing knowledge and technology. These plans must, of course, be sufficiently flexible to incorporate new knowledge and technology as they become available.

Northwestern University is a privately endowed non-sectarian institution founded in 1851. Known for its excellent teaching and imaginative research, the University offers an extremely wide range of educational opportunities in the thirteen schools located on its two campuses. In addition to the Technological Institute, the University's five other schools offering full-time undergraduate work and the Graduate School are located on the Evanston campus. These include the College of Arts and Sciences, the Medill School of Journalism, and the Schools of Education, Music, and Speech. On the Chicago campus are the Schools of Medicine, Dentistry, Law, and the Graduate School of Management. The Evening Divisions offer both undergraduate and graduate work on both campuses and the Summer Session coordinates summer studies both in Evanston and Chicago. The location of Northwestern University affords the graduate student the cultural advantages of a large city in combination with the desirable features of a gracious residential area.

Full-time graduate enrollment in the Technological Institute is over 500. Tuition and fees for full-time graduate students is approximately $3,000 per year.

Admission Requirements

(a) 3.0/4 for MS; 3.5/4 on Master's work overall for PhD.

(b) No specific GRE requirement for verbal and quantitative portions of the exam; advanced examination is not required.

(c) A lower grade point will be considered for applicants with combined GRE scores of 1200 or higher.

(d) Foreign students need a score in excess of 500 on the TOEFL.

(e) Engineering or science majors with mathematics through differential equations are acceptable.

(f) Students with deficiencies in mathematics and/or engineering may be accepted into the program; however, these deficiencies must be made up and will normally require additional time for completion of the program.

(g) Letters of recommendation are required.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	12Q	Optional	No	4Q	12
PhD	36Q	Yes	No	9Q	36

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
A01	Engineering Man's Environment	Gemmell	-	F'72	10
B02	Planning & Managing Man's Environment	Gotaas	-	S'73	29
C46	Meteorology & Hydrology	Gemmell	-	F'72	9
C60	Environmental Control	Pipes	-	S'70	18
C61	Public Health Engineering	Hermann	-	W'73	20
C63	Community Air Pollution	Quon	-	F'72	7
C64	Sanitary Engineering	Gemmell	-	W'73	20
C65-1	Radiological Health	Cember	-	F'72	11
C65-2	Radiological Health	Cember	-	W'73	5
C65-3	Radiological Health	Cember	-	S'73	4
C66	Disperse Sys. in Envir. Health Engr.	Quon	-	W'73	7
C67	Chemistry of Sanitary Engineering	FitzPatrick	-	F'72	10
C68	Biology of Sanitary Engineering	Pipes	-	W'73	9
C69	Occupational Health	Hermann	-	F'72	16
C78	Water Resources Development	Gemmell	-	W'73	5
D60-1	Water & Wastewater Treatment	Gotaas	-	F'72	17
D60-2	Water & Wastewater Treatment	Gotaas	-	W'73	14
D60-3	Unit Processes Laboratory	FitzPatrick	-	S'73	8
D62	Sanitary Engineering Design	Quon	-	S'73	9
D64	Water Pollution	Pipes	-	S'73	9
D65	Radiobiology	Cember	-	W'71	8
D66	Surveillance of Envir. Radioactivity	Cember	-	S'72	9
D67	Advanced Sanitary Chemistry	FitzPatrick	-	W'73	6

D68	Advanced Sanitary Biology	Pipes	-	S'71	6
D69	Occupational Health	Hermann	-	S'73	10
D61	Envir. Measurements Laboratory	FitzPatrick	-	New	-
E16	Seminar in Envir. Health Engr.	Staff	-	S'73	32

Faculty

HERMAN CEMBER
Professor
Department of Civil Engineering
1964

BS	City College of New York	Electrical Engineering	1949
MS	University of Pittsburgh	Biophysics	1952
PhD	University of Pittsburgh	Biophysics	1959

Radiological health, radiotoxicology, mercurialism, effects of radiation exposure on work output, radiogenic carcinoma

100% (50% teaching, 50% research)

Introduction to Health Physics, Pergamon Press, 1969

"A Mathematical Model for the Kinetics of Mercury Metabolism," American Industrial Hygiene Association Journal, 30, p. 367, 1969

"An Estimate of the Inhalation Hazard from Neutron Activated Concrete Dust," American Industrial Hygiene Association Journal, 31, p. 327, 1970

Certified Health Physicist: American Board of Health Physics

Previous full-time professional experience: 22 yrs. (14 yrs. academic and 8 yrs. industry)

Technical expert in occupational health, International Labour Office, Geneva, Switzerland (1961-62)

JOSEPH A. FITZPATRICK
Assistant Professor
Department of Civil Engineering
1972

BS	University of Notre Dame	Civil Engineering	1966
MS	Harvard University	Environmental Engineering	1967
PhD	Harvard University	Environmental Engineering	1972

Water and waste treatment, mechanics and separation of particulates, water chemistry

100% (50% teaching, 50% research)

"Theory for Particle Collection under London and Gravity Forces," Journal Colloid Interface Science, 42, 3, p. 607, 1973

"Filtration of Aqueous Latex Suspensions through Beds of Glass Spheres," Journal Colloid Interface Science, May 1973

"Recent Advances in Filtration Research," submitted for publication

Registered professional engineer: Engineer in Training, Indiana

Previous full-time professional experience: 1 yr. (academic)

Associate Member, American Society of Civil Engineers (1966-date)
Member, Water Pollution Control Federation (1972-date)
Member, American Water Works Association; Chairman, Illinois Section Student Activities (1973)
Member, Institute Colloid and Surface Science (1971-date)

ROBERT S. GEMMELL
Associate Professor
Department of Civil Engineering
1964

BCE	The Ohio State University	Civil Engineering	1956
MS	The Ohio State University	Sanitary Engineering	1957
PhD	Harvard University	Sanitary Engineering	1963

Water resources, water treatment, environmental planning

100% (50% teaching, 50% research)

"Mixing and Sedimentation Basins," Chapter 4 in Water Quality and Treatment, McGraw-Hill, 1971

"On the Centralization of Wastewater Treatment Facilities," Water Resources Bulletin, 8, pp. 669-678, August 1972 (with B. J. Adams and J. S. Dajani)

"Civil Engineering and Urban Systems," Journal Urban Planning and Development Division, American Society of Civil Engineers, 95, pp. 1-14, April 1969

"Performance of Regionally-Related Wastewater Treatment Plants," Office of Water Resources Research, 7/71-6/73, principal investigator

"Urban Water Resources: A Methodology for Management," Office of Water Resources Research, 9/70-8/73, co-principal investigator

"Evaluation of Impacts Arising from the Alternatives for Wastewater Management in the Chicago-South End of Lake Michigan Area," Corps of Engineers, Chicago District, 2/72-10/73, principal investigator

Registered professional engineer: Engineer in Training, Ohio

Previous full-time professional experience: 1 1/2 yrs. (academic)

Member, American Society of Civil Engineers; Editor, Research Newsletter
Member, American Water Resources Association; President, Illinois Section
Member, American Water Works Association; Member, Student Activities Committee

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HAROLD B. GOTAAS
Walter P. Murphy Professor
Department of Civil Engineering
1957

BS	University of South Dakota	Civil Engineering	1928
MS	Iowa State College	Civil Engineering	1930
MS	Harvard University	Sanitary Engineering	1937
ScD	Harvard University	Engineering	1942

Water and waste treatment

100% (60% teaching, 20% research, 20% professional societies, national and regional committees)

"Design Optimization for Biological Filter Models," American Society of Civil Engineers Journal, 1973 (in print)

"Outwitting the Patient Assassin: The Human Use of Lake Pollution," Bulletin of the Atomic Scientist, 25, 5, p. 8, 1969

"Technological Frontiers in Waste Water Management," Journal Water Pollution Control Federation, 38, 5, p. 745, 1966

Registered professional engineer: Illinois and California

Previous full-time professional experience: 27 yrs. (19 yrs. academic and 8 yrs. industry)

Diplomate, AAEE
Member, National Academy of Engineering; Chairman, Environmental Sub-Committee, Project Committee
Honorary Member, American Society of Civil Engineers
Member, Water Pollution Control Federation
Life Member, American Water Works Association
Life Member, American Public Health Association

EDWARD R. HERMANN
Professor
Department of Civil Engineering
1963

BSCE	University of Kentucky	Civil & Sanitary Engineering	1942
MS	Massachusetts Institute of Technology	Sanitary Engineering	1949
CE	University of Kentucky	Sanitary Engineering	1953
PhD	University of Texas	Engineering Med. Science	1957

Environmental health, industrial hygiene, noise and hearing, waste treatment

100% (40% teaching, 40% research, 20% administration)

"Environmental Pollution," Encyclopedia Britannica, 18, pp. 181-186, 1972

"An Audiometric Approach to Noise Control," American Industrial Hygiene Association Journal, 24, pp. 344-356, 1963

"Waste Stabilization Ponds," Sewage and Industrial Wastes, 30, pp. 963-975, 1958 (with E. F. Gloyna)

"Epidemiology of Noise," US Public Health Service, 1965-68, principal investigator

"Acoustics Research," Hupp Corporation, 1966-69, principal investigator

"Pollution Potential of Compressed Solid Wastes," City of Chicago, 1968-70, principal investigator

Registered professional engineer: Illinois, Texas, and New Mexico

Previous full-time professional experience: 17 yrs. (6 yrs. industry, 6 yrs. government, 2 yrs. consulting, and 3 yrs. academic)

Diplomate, AAEE
Diplomate, AAIH
Member (past and present) of more than 50 professional, scientific and governmental committees regarding environmental health engineering. Consultant to various industries and governmental agencies

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WESLEY O. PIPES
Professor
Department of Civil Engineering
1959

BS	North Texas State College	Biology	1953
MS	North Texas State College	Biology	1955
PhD	Northwestern University	Sanitary Engineering	1959

Sanitary biology and chemistry, biological waste treatment

100% (50% teaching, 50% research)

"The Occurrence of Fungi in Activated Sludge," Mycopathologia et Mycologia Applicata, 40, p. 249, 1970 (with W. B. Cooke)

"Modification of Technique for Determination of Aluminum in Water by Atomic Absorption Spectrophotometry," Environmental Science and Technology, 6, p. 645, 1972 (with D. Y. Hsu)

"Condenser Water Discharge Plumes from Waukegan Generating Station under Winter Conditions," Report Published by Commonwealth Edison Company, Chicago, 1973 (with D. W. Pritchard and L. P. Beer)

Member, AEEP
Member, Steering Committee for Third National Conference on Environmental Engineering Education (1973)
Board of Directors, Association of Environmental Engineering Professors (1971-date)
Member, American Society of Civil Engineers; Chairman, Water Resources Division, Illinois Section (1972-date)
Member, Water Pollution Control Federation; Member, Standard Methods Commitee and Program Committee
Consultant, Metropolitan Sanitary District of Greater Chicago, Commonwealth Edison Company, Abbott Laboratories, and others on water pollution control

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J. E. QUON
Professor and Coordinator for Environmental Health Engineering
Department of Civil Engineering
1960

BS	University of California-Berkeley	Civil Engineering	1955
MS	University of California-Berkeley	Sanitary Engineering	1956
PhD	University of California-Berkeley	Sanitary Engineering	1961

Physical properties of aerosols and air pollution control, physical and chemical processes of water and wastewater treatment

100% (40% teaching, 40% research, 20% administration)

"Spark Replica Technique for Measurement of Sulfuric Acid Nuclei," Environmental Science and Technology, 5, pp. 1211-1215, 1971 (with J. Stickney)

"Coagulation of Activated Carbon Suspensions," Journal American Water Works Association, 62, 10, pp. 652-658, 1970 (with R. D. Letterman and R. S. Gemmell)

"A Method for Simulating Wind Conditions during Atmospheric Stagnation Periods," Journal Applied Meterology, 11, 5, pp. 800-805, 1972 (with E. L. Meyer)

"Analyses of Concurrent Demands for Electric Power and Clean Air in Northern Illinois," Illinois Institute for Environmental Quality, 7/72-12/72, principal investigator

"Time--Settlement Behavior of Processed Refuse," US Environmental Protection Agency, 3/71-6/73, co-principal investigator

"Significance of Combustion Nuclei to Air Pollution," US Environmental Protection Agency, 10/66-11/70, principal investigator

Member, AEEP
Member, Environmental Panel of the Projects Committee of National Academy of Engineering (1972-date)
Member, Advisory Board of Environmental Health Resource Center, Illinois Institute for Environmental Quality (1971-date)
Consultant, City of Highland Park

GEORGE THODOS
Walter P. Murphy Professor of Chemical Engineering
Department of Chemical Engineering

PhD	University of Wisconsin	Chemical Engineering	1943

Mass transfer operations and applications to water pollution control and air pollution control
20%

JOSHUA S. DRANOFF
Professor and Chairman
Department of Chemical Engineering

PhD	Princeton University	Chemical Engineering	1960

Absorption technology and applications to gas purification
10%

GEORGE L. PETERSON
Associate Professor of Civil Engineering
Department of Civil Engineering
PhD Northwestern University Urban & Regional Planning 1965
Environmental planning and environmental impact assessment
10%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Health	Master's	14	3	25	1	30	5	20	15	12	7	ENROLLMENT
Engineering	Doctoral	28	8	23	4	22	3	13	4	6	4	
Environmental Health	Master's	8		11		13		11		-		GRADUATES
Engineering	Doctoral	6		4		8		4		-		

	Master's	Doctoral	
EPA traineeship	14	0	SUPPORT
Other traineeship	6	1	
EPA doctoral fellowship	0	1	
Research assistantship	0	1	
Teaching assistantship	1	3	
Other University support (partial)	14	4	
Government employer	0	1	
Self-supported	4	1	
Consulting	34	14	EMPLOYMENT (%)
R & D	3	9	
Industry	20	32	
Federal government	9	23	
Other government	16	5	
Academic	3	17	
Further study	11	0	
Military	4	0	

Facilities

The environmental engineering laboratories provide facilities for instruction and research in sanitary biology and chemistry, air pollution, industrial hygiene, radiological health, the unit operations of water and waste treatment, and water resources planning. Specialized apparatus and instrumentation are available for studies in each area. The total area of the laboratories is approximately 7,500 square feet.

The University of Notre Dame

Notre Dame, Indiana

Department of Civil Engineering
College of Engineering

Civil Engineering
Environmental Health Engineering

Chairman
Department of Civil Engineering
University of Notre Dame
Notre Dame, IN 46556

March 1974

The environmental health engineering program at the University of Notre Dame was officially begun in the fall of 1962. In the development of the program, emphasis was given initially to faculty and course offerings in the area of water supply and water and air pollution. Subsequent attention was then given to expanding course offerings into the areas of solid waste management, environmental health planning and management, environmental law, and environmental science. In addition there now exists a program with the Law School whereby law students may obtain both the JD and MS degrees. Consideration is now being given to the establishment of an MS in environmenal sciences to be administered jointly by the Departments of Civil Engineering and Biology. Overall, an interdisciplinary approach is encouraged.

At the present time there are approximately 22 students in the environmental health engineering program with 15 pursuing the Master's degree and 7 currently working at the doctorate level. Tuition and fees in the graduate program are currently $1,200 per semester. Financial aid covering tuition and stipend is often available in the form of traineeships, teaching assistantships, research assistants, NSF, NDEA, and other fellowships. The amount of support from each is comparable with stipends normally $2,400-3,000 per academic year.

Students are encouraged to participate in the activities of professional societies, both national and local, which deal with environmental problems. Trips to nearby conferences and meetings are sponsored. The department has an active student chapter of the American Society of Civil Engineers which often sponsors speakers in the area of environmental health. In addition, the program itself frequently brings in guest speakers on research topics of current interest.

The University of Notre Dame, a co-educational institution, has a total student enrollment of some 7,500. It is located in northern Indiana just outside the city of South Bend and is within easy driving distance of the metropolitan centers of Chicago, Indianapolis, and Detroit as well as a host of other midwestern universities.

Admission Requirements

(a) 3.0/4 GPA; in some cases 2.75/4 in last two years is acceptable.

(b) GRE is required and should be taken before arrival on campus.

(c) Provisional admission is possible with lower GPA, but financial assistance for such students is not available.

(d) Foreign students must take the English language proficiency test.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	[a]	Optional	-	[b]	-
MS--Envir. Health Engr.	[a]	Optional	-	[b]	-
PhD[c]	-	Yes	1	-	36

[a] 24S (exclusive of thesis) or 27S plus a 3 credit special problem.

[b] Two semesters plus one summer session.

[c] Successful completion of comprehensive written and oral examination in student's minor and major area and defense of a written dissertation are required.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 463	Interdisciplinary Aspects of Environmental Health	Staff	3S	S'74	-
CE 473	Design of Envir. Health Cont. Sys.	Ketchum	3S	S'74	-
CE 483	Aspects of Air Pollution	McFarland	3S	F'73	-
CE 530	Environmental Chemistry	Theis	3S	F'73	-
CE 531	Water Quality Engineering	Ketchum	3S	F'73	-
CE 533	Solid Waste Management	Theis	3S	S'73	-
CE 538	Particulate Mechanics	McFarland	3S	S'74	-
CE 539	Air Pollution Control Lab	McFarland	3S	S'74	-
CE 632	Biogeochemical Cycles in Nat. Waters	Theis	3S	S'74	-
CE 633	Water Quality Lab	Staff	3S	F'73	-
CE 635	Envir. Health Planning & Management	Verhoff	3S	S'74	-
Bio 420	Aquatic Biology	Ross	4S	S'74	-
MBio 412	Environmental Microbiology	Pleasants	3S	S'73	-
Bio 411	Biostatistics	Staff	3S	F'73	-
Bio 521	Community Ecology	McIntosh	3S	F'73	-
Bio 522	Population Ecology	Staff	3S	F'73	-
Chem 521	Fundamental of Biochemistry	Bretthauer	3S	F'73	-
Chem 613	Instrumental Methods of Analysis	Bottei	3S	F'73	-
Cheg 437	Process Control & Simulation	Staff	3S	F'73	-
Cheg 456	Polymer Engineering	Staff	3S	S'74	-
Cheg 544	Transport Phenomena I	Verhoff	3S	F'73	-
Cheg 545	Transport Phenomena II	Verhoff	3S	S'74	-

Econ 518	Natural Res., Tech. & Conservation	Staff	3S	F'73	-
Econ 567	Public Policy/Water & Air Poll. Cont.	Durbin	3S	S'74	-
Law 520	Natural Resources Management	McIntire	3S	F'73	-
Law 535	Land Use Planning	McIntire	3S	S'74	-
Law 544	Environmental Law Seminar	McIntire	3S	S'74	-
Arch 641	Urban & Regional Planning Seminar I	Staff	3S	F'73	-
Arch 642	Urban & Regional Planning Seminar II	Staff	3S	S'74	-
EaSc 559	Environmental Geology	Winkler	3S	F'73	-
ME 499	Nuclear Engineering	Lucey	3S	F'73	
CE 493	Water Resources Engineering	Staff	3S	F'73	-
CE 540	Hydrology	Staff	3S	S'73	-
CE 541	Seepage & Groundwater Flow	Marley	3S	S'73	-

Faculty

LLOYD H. KETCHUM, JR.
Assistant Professor of Civil Engineering
1973

BS	Michigan State University	-	1960
MS	University of Michigan	-	1964
MPH	University of Michigan	-	1964
PhD	University of Michigan	-	1969

Water and wastewater treatment, advanced waste treatment, water quality engineering

100% (60% teaching, 30% research, 10% administration)

"Coagulation of Stormwaters and Low Alkalinity Wastewaters," Journal Water Pollution Control Federation, 45, p. 53, January 1974 (with W. J. Weber, Jr.)

Registered professional engineer: Illinois and Indiana

Previous full-time professional experience: 11 yrs. (2 yrs. industry, 3 yrs. consulting, and 6 yrs. academic)

Member, American Society of Civil Engineers
Member, Water Pollution Control Federation
Member, American Water Works Association
Member, American Society for Engineering Education

THOMAS L. THEIS
Assistant Professor of Civil Engineering
1973

BS	University of Notre Dame	-	1968
MS	University of Notre Dame	-	1970
PhD	University of Notre Dame	-	1972

Aquatic chemistry, chemistry of water and wastewater treatment, solid waste management

100% (50% teaching, 40% research, 10% administration)

"Phosphate Removal: Summary of Papers," Discussion, Journal American Society of Civil Engineers, Proc. Paper 7441, August 1970 (et al.)

"The Stabilization of Ferrous Iron by Organic Compounds in Natural Waters," in Trace Metals and Metal-Organic Interactions in Natural Waters (P. C. Singer, ed.), Ann Arbor Science Publishers, 1973

"Complexation of Iron (II) by Organic Matter and Its Effect on Iron (II) Oxygenation," accepted for publication by Environmental Science and Technology

Member, American Water Works Association
Member, Water Pollution Control Federation
Member, American Chemical Society
Member, Chi Epsilon
Member, Tau Beta Pi

ANDREW R. McFARLAND
Associate Professor of Civil Engineering
1970

BS	University of Minnesota	-	1957
MS	University of Minnesota	-	1960
PhD	University of Minnesota	-	1967

Air pollution--the collection and assessment of aerosols, and industrial hygiene

100% (50% teaching, 40% research, 10% administration)

"Sources and Control of Particulate Pollutants," in Particulate Matter in the Urban Atmosphere (K. Ragland, ed.), University of Wisconsin Press, Madison, 1972

"Application of a Light-Scattering Aerosol Counter and a Four-Stage Impactor Sampler," American Industrial Hygiene Association Journal, 32, p. 35, 1971

Previous full-time professional experience: 5 yrs. (1 yr. research and 4 yrs. academic)

Member, Air Pollution Control Association
Member, American Society of Testing Materials

ARUN K. DEB
Visiting Assistant Professor
1974

BE	University of Calcutta	-	1957
MS	University of Wisconsin	-	1961
PhD	University of Calcutta	-	1968

Water and wastewater treatment process design, sewage and water distribution system analysis and optimization

60% (50% teaching, 10% research)

"Discussion on Theory of Multilayer Filtration," Journal Sanitary Engineering Division, American Society of Civil Engineers, October 1970

"Theoretical Aspects of Head Loss in Water Filtration," Journal Indian Water Works Association, October 1970

"Numerical Solution of Filtration Equations," Journal Sanitary Engineering Division, American Society of Civil Engineers, April 1970

Previous full-time professional experience: 13 yrs. (academic)

FRANCIS H. VERHOFF
Associate Professor of Chemical Engineering
1969

BChE	Dayton University	-	1964
MSE	University of Michigan	-	1965
PhD	University of Michigan	-	1968

Environmental modeling and analysis

50% (25% teaching, 25% research)

"Lake Water Quality Prediction through System Modeling," Proceedings, 1971 Summer Computer Simulation Conference, Boston, pp. 1061-1070, July 1971 (et al.)

"Theoretical Analysis of a Conserved Nutrient Ecosystem," Journal Theoretical Biology, 33, pp. 131-147, 1971 (with F. E. Smith)

"Biogeochemical Modeling of Eutrophic Lakes," Proceedings, 5th Interaction Water Pollution Conference, Advances in Water Pollution Research, Pergamon Press, p. III-21, 1972 (et al.)

"Evaluation of Phosphorus Dynamics in a Watershed," accepted for publication by Journal Environmental Engineering Division, American Society of Civil Engineers (with T. H. Cahill)

"Rates of Carbon, Oxygen, Nitrogen and Phosphorus Cycling through Microbial Populations in Stratified Lakes," Proceedings, Modeling the Eutrophication Process Workshop, Utah State University, pp. 111-120, 1973 (with C. F. Cordeiro and W. F. Echelberger, Jr.)

Member, American Institute of Chemical Engineers
Member, American Chemical Society

RICHARD W. GREENE
Assistant Professor of Biology
PhD University of California - 1969
Algal physiology, environmental biology
15%

QUENTIN ROSS
Assistant Professor of Biology
PhD Michigan State University - 1971
Aquatic biology
15%

JULIAN R. PLEASANTS
Associate Professor of Microbiology
PhD University of Notre Dame - 1966
Environmental microbiology
10%

MICHAEL V. McINTIRE
Associate Professor of Law
JD University of Wisconsin - 1963
Environmental law
20%

JERRY J. MARLEY
Assistant Professor of Civil Engineering
PhD Iowa State University - 1969
Groundwater hydrology
15%

Students

		69-70 FT PT	70-71 FT PT	71-72 FT PT	72-73 FT PT	73-74 FT PT	
Environmental Health	Master's	-	-	-	-	15	ENROLLMENT
Engineering	Doctoral	-	-	-	-	7	
Environmental Health	Master's	2	3	6	8	-	GRADUATES
Engineering	Doctoral	1	1	2	3	-	

	Master's	Doctoral	
Research assistantship	6	3	
Teaching assistantship	0	3	
EPA traineeship	5	0	SUPPORT
Self supported	4	0	
Industrial fellowship	0	1	

	Master's & Doctoral	
Federal government	32	
Other government	16	EMPLOYMENT (%)
Industry	9	
Consulting	6	
Further study	13	
Academic	24	

Facilities

Within the Department of Civil Engineering there are approximately 5,000 square feet of laboratory and office space currently in use by the environmental health engineering program. The laboratories are well equipped for education and research training. The Department has four EAI TR-20 solid-state electronic analog computers. The College of Engineering maintains a Computational Laboratory open to all on an "open shop" basis which contains a General Automatic 18/30 computer system. The University Computer Center has an IBM 370/158 system which is available for more extensive research work.

Library services are available through the University Library system which includes outstanding general and research library facilities.

The Ohio State University

Columbus, Ohio

College of Engineering
Department of Civil Engineering

Water Resources

Director
Water Resources Center
The Ohio State University
Columbus, OH 43210
(614) 422-2334

February 1974

The Department of Civil Engineering offers graduate programs leading to both the MS and PhD in environmental engineering, environmental engineering systems, environmental chemistry, environmental management, hydrological and hydraulic engineering, and ocean and coastal engineering. Study in air pollution control and solid wastes management is offered in cooperation with other departments of the University.

The Ohio State University has an enrollment of about 45,000 students. It is the principal center of graduate and professional study in Ohio and offers instruction in all disciplines. The University library system holds over 2,700,000 volumes and subscribes to 14,000 journals. Computer facilities consist of several IBM machines including one 370/165, two 360/20's, one 7094, two 2780's, one 1620, and one 1130.

Admission Requirements

(a) 2.70/4 for MS and 3.25/4 (in graduate work) for PhD.

(b) Both aptitude and advanced engineering examination of the GRE are required if GPA is unsatisfactory or if degree is from an unaccredited school.

(c) Conditional admission is possible at the discretion of department graduate committee. The student must maintain 3.0/4 in course work and petition for transfer to regular status prior to graduation.

(d) Foreign students must score at least 500 on TOEFL or at least 80 on Michigan Test of English Language Proficiency.

(e) Students with a BS in engineering or BS in the natural sciences from an accredited school are acceptable into the program.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	36Q	Yes[a]	No	3Q	12
PhD[c]	90Q[b]	Yes	No	4Q	36[d]

[a] In special circumstances, 14Q may be substituted for thesis.

[b] MS degree may be used to satisfy 45Q.

[c] The student must pass a written and oral general examination administered near the end of his plan of study, complete a satisfactory dissertation, and pass a final oral examination (centered on field of specialization).

[d] Beyond BS.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
610	Analysis Natural & Polluted Water	Rubin	4Q	A'73	13
613[3]	Applied Hydrology	Ricca	4Q	A'73	26
614	Intermediate Fluid Mechanics	Ricca	3Q	W'74	15
615[4]	Dynamic Oceanography	Bedford	4Q	New	-
713[1,2]	Environmental Engineering Measurement	Rubin	4Q	W'74	9
715[2]	Water Quantity Systems	Whitlatch	4Q	S'74	10
717	Solid Waste Management	Stiefel	3Q	W'74	15
719[1,2]	Stream Sanitation	Sykes	4Q	A'73	21
720[1,2]	Water Quality Modeling	Whitlatch	4Q	W'74	9
721[3,4]	Design Hydraulics Structures	Ricca	4Q	W'74	21
722[3]	Open Channel Hydraulics	Ricca	4Q	S'74	16
724[3,4]	Ocean & Coastal Engineering	Bedford	4Q	New	-
729[4]	Estuary Hydrodynamics & Processes	Bedford	4Q	New	-
794[2]	Planning Civil Engineering Investment	Whitlatch	4Q	S'74	6
810[1,2]	Physical Treatment Processes	Stiefel	4Q	A'73	8
811[1,2]	Biological Treatment Processes	Sykes	5Q	W'74	7
812[1,2]	Chemical Treatment Processes	Rubin	5Q	S'74	9
814	Industrial Wastewater Treatment	Stiefel	3Q	S'74	7

820[2,3,4]	Advanced Hydrology	Ricca	5Q	W'74	6
822[3,4]	Hydromechanics	Bedford	4Q	New	-
850[2]	Seepage in Permeable Materials	Gray	4Q	A'73	10
885[2]	Ecosystem Theory	Sykes	4Q	S'74	4

[1] Normally required for MS environmental engineering program.
[2] Normally required for MS environmental engineering systems program.
[3] Normally required in MS hydrological and hydraulic engineering program
[4] Normally required in MS ocean and coastal engineering program

The program in environmental chemistry makes extensive use of courses in the Department of Chemistry. The program in environmental engineering management is administered jointly with the Division of Public Administration.

Faculty

KEITH W. BEDFORD
Assistant Professor
Department of Civil Engineering
1973

BSME	Union College	Mechanical Engineering	1969
MSME	Union College	Mechanical Engineering	1971
PhD	Cornell University	Civil & Environmental Engineering	1974

Fluid mechanics, hydraulics, hydrology, stratified lake circulation, oceanography

100% (50% teaching, 50% research)

"Stochastic Basis for Comprehensive River Basin Planning," Office of Water Resources Research Report, NTIS, 1971 (et al.)

"Transport Equation Stability and Estuary Modeling," Journal Hydraulics Division, American Society of Civil Engineers, 97, HY12, December 1971 (with F. C. Haag)

"Case Studies in Educational Efforts," The Social and Economic Aspects of Water Resources Development (Proceedings American Water Resources Association Conference), 1971

Member, American Society of Civil Engineers
Member, American Water Resources Association
Member, American Geophysical Union
Member, American Society of Mechanical Engineers
Member, Sigma Xi

VINCENT T. RICCA
Professor
Department of Civil Engineering
1966

BSCE	City College of New York	Civil Engineering	1962
MSCE	Purdue University	Hydrology	1964
PhD	Purdue University	Hydraulic Engineering	1966

Fluid mechanics, hydraulic engineering, hydrology--streamflow simulation models, stream profile models

100% (45% teaching, 30% research, 25% administration)

"Acid Mine Drainage Quantity and Quality Generation Model," American Society of Mining Engineers, Chicago, February 1972 (with K. Chow)

"The Ohio State University Version of the Stanford Streamflow Simulation Model," in Technical Aspects, Programs, and User Manuals, The Water Resources Center, Engineering Experiment Station, The Ohio State University, June 1972

"The Role of Streamflow Simulation Models in the Design of Highway Drainage Facilities," Proceedings, 25th Ohio Highway Engineering Conference, April 1971

"Influence of Landuse on Runoff from Agricultural Watersheds," Transactions American Society of Agricultural Engineers, 13, 2, 1970 (et al.)

"The Relation of Refuse Pile Hydrology to Acid Production," 3rd Coal Mine Drainage Symposium, Mellon Institute, Pittsburgh, April 1970 (with M. Good and K. Shumate)

"Streamflow Simulation and Flood Profile Determination in Ohio," Ohio Department of Natural Resources, 9/73-7/74, project director and principal investigator

"Resource Allocation to Optimize Mining Pollution Control," US Environmental Protection Agency, 7/72-1/74, principal investigator

"Hydrologic Investigation of Potential Power Plant Site on Sandusky Bay," Ohio Power Company, 7/73-7/74, principal investigator

Registered professional engineer: Ohio

Previous full-time professional experience: (government and consulting)

Member, Chi Epsilon; Faculty Advisor to Ohio State University Chapter
Member, American Society of Civil Engineers; Officer in Central Ohio Section
Member, American Water Resource Association; Secretary-Treasurer of Ohio Section
Member, American Society for Engineering Education
Member, American Geophysical Union, Water Resource Research

ALAN J. RUBIN
Associate Professor
Department of Civil Engineering
1968

BSCE	University of Miami	Civil Engineering	1959
MSSE	University of North Carolina-Chapel Hill	Sanitary Engineering	1962
PhD	University of North Carolina-Chapel Hill	Environmental Chemistry	1966

Environmental and analytical chemistry, chemical treatment processes and public health

100% (50% teaching, 40% research, 10% administration)

"Microflotation: New Low Gas Flow-Rate Foam Separation Technique for Bacteria and Algae," Biotechnology and Bioengineering, 8, p. 135, 1966 (et al.)

"Coagulation of the Bacterium Escherichia Coli by Aluminum Nitrate," Environmental Science and Technology, 2, p. 358, 1968 (with G. P. Hanna)

"Removal of Trace Metals by Foam Separation Processes," Journal American Water Works Association, 60, p. 832, 1968

Chemistry of Water Supply: Treatment and Distribution, Ann Arbor Science Publishers, Ann Arbor, 1974 (editor)

"Coagulation of Escherichia coli by Neutral S," Water Research, 3, p. 843, 1969 (with P. L. Hayden and G. P. Hanna)

"Chemical Aspects of the Toxicity of Chlorinated Effluents," Office of Water Resources Research, 1973-75, principal investigator

"Coagulation of Clays with Hydrolyzing Metals," Office of Water Resources Research, 1969-72, principal investigator

"Removal of Trace Metals from Water by Ion Flotation," Office of Water Resources Research, 1968-71, principal investigator

Previous full-time professional experience: 3 yrs. (academic)

Member, American Chemical Society
Member, American Water Works Association
Member, Water Pollution Control Federation
Member, Ohio Academy of Science

ROBERT C. STIEFEL
Associate Professor and Director, Water Resources Center
Department of Civil Engineering
1972

BS	Drexel University	Civil Engineering	1957
MS	State University of Iowa	Hydraulics	1959
PhD	Rensselaer Polytechnic Institute	Environmental Engineering	1968

Water resources engineering and physical and industrial treatment processes

100% (25% teaching, 25% research, 50% administration)

"Mercury in the Fisheries Environment," Annual Report to Ohio Department of Natural Resources, Division of Wildlife, 1973

"Water Resources Education in Civil Engineering," American Society of Civil Engineers Conference on Civil Engineering Education, 1974 (with V. T. Ricca)

"Mercury in the Fisheries Environment," Ohio Department of Natural Resources, 7/72-6/74, project leader

"Lake Erie Nutrient Control Program: An Assessment of Its Effectiveness in Controlling Lake Eutrophication," US Environmental Protection Agency, 7/73-6/75, investigator

"Land Use Activities/Water Quality in Great Lakes Basin," Great Lakes Basin Commission, 12/73-6/74, project coordinator

Registered professional engineer: Pennsylvania and Ohio

Previous full-time professional experience: 10 yrs. (academic)

Member, American Society of Civil Engineers; Faculty Advisor, Student Chapter; Chairman, Local Arrangements Committee, Conference on Civil Engineering Education
Member, Water Pollution Control Federation
Director, Water Resources Center, Ohio
Member, University Council on Water Resources

ROBERT M. SYKES
Assistant Professor
Department of Civil Engineering
1972

BSCE	Northeastern University	Civil Engineering	1966
MSCE	Purdue University	Environmental Engineering	1968
PhD	Purdue University	Environmental Engineering	1970

Biological processes for wastewater treatment, stream sanitation, ecosystem theory

100% (50% teaching, 50% research)

"Anaerobic Digestion in Biological Waste Treatment," Progr. Industrial Microbiology, 9, p. 155, 1971 (with E. J. Kirsch)

"The Identity of the Limiting Nutrient and the Specific Growth Rate," Journal Water Pollution Control Federation, 45, p. 888, 1973

"The Trophic-Dynamic Aspects of Ecosystem Models," Proceedings, 16th Conference Great Lakes Research, in press

"The Theory of Multiple Limiting Nutrients," Journal Water Pollution Control Federation, in press

"Washout Processes in Lake Systems," Office of Water Resources Research, 7/71-10/72, co-investigator

"Stream Deoxygenation Rates," Office of Water Resources Research, 7/73-6/74, principal investigator

"Biodegradation of Disposable Diapers in Septic Tanks," Procter and Gamble 1/73-1/74, principal investigator

Previous full-time professional experience: 2 yrs. (academic)

Member, American Water Works Association
Member, Water Pollution Control Federation

E. EARL WHITLATCH
Assistant Professor
Department of Civil Engineering
1973

BSCE	Carnegie-Mellon University	Civil Engineering	1965
MS	The Johns Hopkins University	Environmental Engineering	1967
PhD	The Johns Hopkins University	Environmental Engineering	1972

Environmental and water resources systems, mathematical programming and economic theory

100% (50% teaching, 50% research)

"Water Quality Management of Domestic and Industrial Wastes," presented at 43rd National Meeting of the Operations Research Society of America, Milwaukee, March 1973 (with C. S. ReVelle)

Previous full-time professional experience: 2 yrs. (government)

Member, American Society of Civil Engineers
Member, American Water Works Association
Member, American Water Resources Association
Member, American Geophysical Union

Students

		68-69 FT PT	69-70 FT PT	70-71 FT PT	71-72 FT PT	72-73 FT PT	
Environmental Engr. & Chemistry	Master's	3	6	8	8	6	ENROLLMENT
	Doctoral	4	3	1	2	2	
Hydrological & Hydraulic Engr.	Master's	5	9	6	4	9	
	Doctoral	1	1	0	0	0	
Environmental Engr. & Chemistry	Master's	3	2	4	7	4	GRADUATES
	Doctoral	1	1	1	0	0	
Hydrological & Hydraulic Engr.	Master's	4	2	4	2	6	
	Doctoral	0	0	0	1	0	
Environmental Engr. & Chemistry	Master's	1	NON-US NATIONALS				
	Doctoral	1					
Hydrological & Hydraulic Engr.	Master's	0					
	Doctoral	0					

	Master's & Doctoral	
EPA traineeship	2	SUPPORT
Research assistantship	11	
Teaching assistantship	4	

EMPLOYMENT (%)

Consulting	42
R & D	2
Industry	9
Federal government	7
Other government	16
Academic	5
Further study	7
Military	12

Facilities

In addition to those laboratory facilities normally available to programs in water resources and environmental engineering, The Ohio State University maintains a laboratory and ship on Lake Erie and the US Department of Agriculture operates an experimental watershed at Coshocton, Ohio, both of which are available to students and faculty for research. The presence of law, medical, and agricultural colleges (and their associated facilities) on campus offers enhanced opportunities for interdisciplinary research and study.

University of Oklahoma

Norman, Oklahoma

School of Civil Engineering and Environmental Science
College of Engineering

Civil Engineering
Environmental Science

Dr. Larry W. Canter, Director
Civil Engineering and Environmental Science
202 West Boyd, Room 334
University of Oklahoma
Norman, OK 73069
(405) 325-5911

May 1973

The program of civil engineering and environmental science covers instruction and research in the problem areas of water resources, air resources, radiological health, industrial hygiene, environmental assessment, urban systems, and solid wastes management. While the program provides training in depth for these areas, interdisciplinary associations are encouraged to develop team approaches to the complex environmental problems encountered today.

Training is provided not only for engineers with various academic backgrounds but also for biologists, chemists, physicists, and social scientists. Nonresident lecturers include Federal and state environmentalists and engineers such as personnel from the US Environmental Protection Agency, US Public Health Service, and Oklahoma State Health Department. The MS in environmental science degree is offered for all scientists. Engineers may receive the MS in engineering degree. The PhD degree program is open to qualified candidates with either a science or engineering degree. The University of Oklahoma is able to offer graduate stipends, teaching and research assistantships to qualified candidates at the Master's and doctoral levels.

Admission Requirements

(a) 3.0/4 for Master's and 3.0/4 overall for PhD.

(b) No GRE examination is required. Written qualifying examinations are required for admission to the PhD program.

(c) Admission to Master's programs is possible for GPA down to 2.5/4 provided strong recommendations are submitted. Student must obtain a 3.0/4 in first semester to obtain full graduate standing.

(d) Foreign students must score a minimum of 550 on the TOEFL to be admitted.

(e) Any engineering discipline at an accredited institution is acceptable. Individuals with undergraduate degrees in the sciences are usually acceptable as are persons in administration or the social sciences.

(f) Nonengineers must take the following courses in order to pursue an MCE degree: sanitary engineering analysis and unit operations, sanitary and hydraulic systems and process design, hydromechanics processes, thermodynamics, heat transfer and fluid mechanics, and applicable computer and math courses.

(g) Applicants must have three letters of recommendation submitted from former professors or employers.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MES	32S[a]	Optional	No	12 mo.	12-18
MCE	32S[a]	Optional	No	12 mo.	12-18
PhD	90S	Yes	1[b]	[c]	36

[a] or 26S and thesis.

[b] Optional.

[c] Last year.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 3213	San. Engr. Anal. & Unit Operations	Reid	-	F'73	25
CE 4233	San. & Hyd. Systems & Proc. Design	Streebin	-	F'72	23
CE 5020	Environmental Impact Assessment	Canter	-	S'73	28
CE 5252	Radioactive Waste Management	Canter	-	F'72	10
CE 5303	Air Quality Control	Nelson	-	F'72	15
CE 5433	Application of Quant. Decision Techniques to Public Sector	Southard	-	S'72	22
CE 5600	Envir. Quality Mgt. Fld. Training	Streebin	-	Su'72	8
CE 5703	Marine & Est. Water Quality Mgt.	Streebin	-	S'73	10
CE 5843	Hydrology	Harp	-	S'73	9
CE 5852	Groundwater & Seepage	Laguros	-	S'73	6
CE 5923	Air Pollution Control Engr.	Canter	-	F'72	18

CE 5933	Des. Air Pollution Control Systems	Canter	-	New	-
CE 6030	Radiation Safety Prog.	Nelson	-	S'72	12
CE 6210	Industrial Noise & Vibration	Nelson	-	New	-
CE 6980	Research for Doctor's Dissertation	Staff	-	S'73	-
ES 4114	Environmental Measurements	Klehr	-	S'73	16
ES 5053	Radiological Health	Canter	-	F'72	8
ES 5083	Effects of Ion. Radiation	Robertson	-	S'73	4
ES 5113	Advanced Environmental Chemistry	Klehr	-	F'72	7
ES 5133	Advanced Environmental Biology	Robertson	-	S'73	20
ES 5223	Chemical Aspects of Envir. Science	Klehr	-	S'71	20
ES 5232	Housing, Inst. & Hosp. Envir. Survey	Guyer	-	S'72	8
ES 5273	Rad. Surveil., Assay & Haz. Gene.	Nelson	-	F'72	5
ES 5323	Biological Aspects of Envir. Science	Robertson	-	S'71	20
ES 5500	Public Health Fld. Prac.	Robertson	-	Su'72	13
ES 5624	Food Protection, Sys. & Analysis	Guyer	-	F'72	6
ES 5663	Noise Environment	Nelson	-	S'72	22
ES 6210	Industrial Hygiene II	Nelson	-	S'73	28
ES 6210	Envir. Science Special Topics	Staff	-	S'73	-
ES 6260	Advanced Radiological Health Lab.	Nelson	-	Su'72	10
ES 6323	Vector Control & Solid Wastes Mgt.	Robertson	-	F'72	-
ES 6971	Public Health Seminar	Robertson	-	F'72	6
CE/ES 6703	Water Quality Management	Streebin	-	S'73	12
CE/ES 5032	Radioisotope Technology	Klehr	-	S'73	7
CE/ES 5041	Radioisotope Technology Lab.	Klehr	-	S'73	6
CE/ES 5063	Radiation Protection Engr.	Nelson	-	S'73	4
CE/ES 5244	Water & Waste Treatment Proc. & Oper.	Streebin	-	F'72	12
CE/ES 5653	Industrial Hygiene Engr.	Nelson	-	F'72	26
CE/ES 5803	Solid Waste Systems Planning	Canter	-	S'73	18
CE/ES 5980	Research for Master's Thesis	Staff	-	S'73	-
CE/ES 6604	Sanitary Design & Water Resources	Reid	-	S'73	40
CE/ES 6613	Water Resources System Analysis	Reid	-	F'72	18
Chem 5753	Principles of Biochemistry	Ciereszko	-	F'72	45
Zool 4462	Limnology	DeNoyelles	-	S'73	42
Bios & Epid 5163	Biostatistical Methods I	Anderson	-	F'72	20

Cores of approximately 12S are required for the different specialties in civil engineering and in environmental science. Each core will vary according to the specific needs of the specialty.

Faculty

LARRY W. CANTER
Associate Professor and Director
Civil Engineering and Environmental Science Department
1969

BS	Vanderbilt University	Civil Engineering	1961
MS	University of Illinois	Sanitary Engineering	1962
PhD	University of Texas	Environmental Health Engineering	1967

Industrial waste treatment, air pollution, water resources, solid waste management, radiological health, environmental assessment

100% (30% teaching, 40% research, 30% administration)

"Contamination of Oysters by Pesticides," Journal Sanitary Engineering Division, American Society of Civil Engineers, 1970 (with D. R. Rowe and J. W. Mason)

"The Impact of Pollution and Its Control on the Highway Industry," presented 10th Annual Highway Conference, State of Oklahoma, Norman, 1971

"Total Water and Waste System for a Canning Plant," Proceedings, 23rd Industrial Waste Conference, Oklahoma State University, April 1972 (with L. E. Streebin)

"Tulsa Public Service," Commercial Contract, 3/72---, principal investigator

"Ambient Air Quality Assessment Adjacent to a Zinc Smelt," Blackwell Zinc Company, 10/71-9/73, principal investigator

"Engineering Foundation Conference on Preparing Environmental Impact Statements," National Science Foundation, 1/73-8/73, principal investigator

Registered professional engineer: Louisiana

Previous full-time professional experience: 5 yrs. (3 yrs. government and 2 yrs. academic)

Member, AEEP
Co-Chairman, Engineering Foundation Conference on "Preparation of Meaningful Environmental Impact Statements," Heniker, New Hampshire (1973)
Chairman, Seminar Committee, American Association of Professors in Sanitary Engineering (1970)
Course Director, Shelter Survey Techniques Course, Norman, Oklahoma (1970, 1972)

GEORGE W. REID
Regents Professor and Director, Bureau of Water and Environmental Resources Research
Civil Engineering and Environmental Science Department
1950

BS	Purdue University	Civil Engineering	1942
SM	Harvard University	Sanitary Engr. & Industrial Hyg.	1943
CE	Purdue University	Civil Engineering	1952

Water resources systems, process design, environmental problems

100% (30% teaching, 60% research, 10% administration)

"Engineering Evaluation of Virus Hazard in Water," Report of Committee on Environmental Quality Management of the Sanitary Engineering Division, Proceedings American Society of Civil Engineering, 96, SA1, February 1970 (et al.)

"Radioisotopic Technique for Studying Biological Slime-Treatment Processes," Isotopes and Radiation Technology, 9, 2, pp. 244-245, Winter 1971-72

"On Nutritional Pollution," International Journal Environmental Studies, 2, pp. 271-275, 1972

"Research of Lower Cost Methods of Water and Waste Treatment," LDCS, Agency for International Development, 3/73-12/75, principal investigator

"Interdisciplinary Research on Engineering Systems for Urban Areas," National Science Foundation, 5/71-8/73, principal investigator

"Water Resources Development," US Environmental Protection Agency, 7/72-7/73, principal investigator

Registered professional engineer: Oklahoma

Previous full-time professional experience: 3 yrs. (consulting)

Member, AEEP
Diplomate, AAEE
Member, Governor's Long Range Water Resources Council
Chairman, Consultant Board, US Department of the Interior
World Health Organization/Pan American Health Organization, Water Quality and Systems Approach to Water Quality Management--Mexico (1968), Peru (1969), Columbia (1970), Barbados (1971), Panama (1971), Mexico (1972)

LEALE E. STREEBIN
Associate Professor
Civil Engineering and Environmental Science Department
1966

BS	Iowa State University	Civil Engineering	1961
MS	Oregon State University	Civil Engineering	1964
PhD	Oregon State University	-	1967

Process design, sanitary engineering

100% (25% teaching, 75% research)

"Water Conservation and Reuse at the Stilwell Canning Company," Proceedings, 26th Purdue Industrial Waste Conference, 1971 (with L. W. Canter)

"Process System Design for a High Strength Large Volume Cannery Waste on a Small Receiving Stream," Water and Wastes Engineering, 1970 (with G. W. Reid)

"Comparison between Thermophilic and Mesophilic Aerobic Biological Waste Treatment," Bureau of Water Resources Research, University of Oklahoma, 1967 (with D. C. Phillips)

"Start-Up and Operation of Biological Waste Disposal Process under Non-Equilibrium Conditions," US Environmental Protection Agency, 4/72-3/74, principal investigator

"Comprehensive Water Quality Management Planning for the State of Oklahoma," Oklahoma State Grant, 1/73-12/74, principal investigator

"Cooperative Agreement for Conducting Forestry Investigations," US Department of Agriculture, Forest Service, 6/71-12/72, principal investigator

Registered professional engineer: Oklahoma

Member, AEEP
Member, Water Pollution Control Federation
Member, American Water Works Association
Member, American Society of Civil Engineers

JOAKIM G. LAGUROS
Professor
Civil Engineering and Environmental Science Department
1963

BS	Robert College	Civil Engineering	1946
MS	Iowa State University	Highway Engineering	1955
PhD	Iowa State University	Soil Engineering	1962

Soils and ground wastes

100% (50% teaching, 50% research)

"A Computer Program for Pavlovsky's Groundwater Problem," Journal Irrigation and Drainage Division, American Society of Civil Engineers, 94, March 1968 (with G. Papadopoulos)

"Siltation in Impoundments," Proceedings, Oklahoma Academy of Science, 53, 1973 (with J. F. Harp)

"Accidents and Roadway Geometrics at Bridge Approaches," Public Works, 104, 4, April 1973 (with J. Behnam)

"Stabilization of Oklahoma Shales," Oklahoma State Grant, 3/73---, principal investigator

Registered professional engineer: Oklahoma

Previous full-time professional experience: 1 yr. (academic)

Member, American Society for Engineering Education
Member, Highway Research Board
Member, Clay Minerals Society

ANTTI PETRI TALVITIE
Assistant Professor
Civil Engineering and Environmental Science Department
1971

BS	University of Technology	-	1964
MS	Northwestern University	-	1968
PhD	Northwestern University	-	1971

Transportation systems analysis

100% (75% teaching, 25% research)

"Multiple Viewpoints in the Evaluation of Alternative Transportation Plans," Journal Finnish Society of Civil Engineers, II, pp. 81-86, 1969

"A Comparison of Probabilistic Mode Choice Models: Estimation Methods and System Inputs," HRB Record, 392, pp. 111-120, 1972

"A Direct Demand Model for Downtown Work Trips," Transportation, 2, 1, Elsevier Publishing Company, The Netherlands, 1973

"A Direct Demand Model for Downtown Work Trips," National Science Foundation, 4/73-3/75, principal investigator

Registered professional engineer: Oklahoma

EDWIN H. KLEHR
Professor
Civil Engineering and Environmental Science Department
1961

BS	St. John's University	Chemistry	1954
PhD	Iowa State University	Chemistry	1959

Water chemistry, radio-chemistry

100% (70% teaching, 30% research)

"Radioactive Tracers in Water Analysis--Sulfate Determination," 12th Tetrasectional Meeting, Oklahoma American Chemical Society, 1966

"Use of Radioactive Tracers in Water Analysis--Chloride Determination," 54th Annual Meeting, Oklahoma Academy of Science, 1965

Previous full-time professional experience: 2 yrs. (academic)

ROBERT Y. NELSON
Assistant Professor
Civil Engineering and Environmental Science Department
1963

BS	University of Oklahoma	Civil Engineering	1959
MS	University of Oklahoma	Sanitary Engineering	1960
PhD	University of Texas	Environmental Engineering	1964

Air, radiation, and industrial sanitation

100% (50% teaching, 50% research)

"Air Pollution Potential from an Urban Freeway," Oklahoma Academy of Science, December 1969

"Edge Effect of Photons in a Bounded Medium," Journal Nuclear Medicine, MIRD Pamphlet No. 5, 1969 (with Clawser)

"Investigation of Effects of Metallic Ions on Biological Waste Treatment Processes," Water and Sewage Works, 1968 (et al.)

"Radiological Health Specialist Training Grant," US Department of Health, Education and Welfare, 9/71-8/73, principal investigator

Registered professional engineer: Oklahoma

Member, Air Pollution Control Association
Member, American Nuclear Society
Certified Health Physicist

JAMES M. ROBERTSON
Associate Professor
Civil Engineering and Environmental Science Department
1967

BS	North Texas State University	-	1960
MS	Oregon State University	-	1964
PhD	Oregon State University	-	1967

Sanitary biology, limnology, vector control, aquatic microbiology

100% (50% teaching, 50% research)

"Glucose Dissimilation by Strains of *Sphaerotilus natans*," *Bacteriological Proceedings*, American Society for Microbiology, p. 78, 1966 (with C. M. Gilmour)

"A Comparison of Microscopic and Macroscopic Indicators of Pollution," *The Proceedings of the Oklahoma Academy of Sciences*, 50, pp. 49-56, 1970 (with J. Gallup and L. E. Streebin)

"A Technique for Airborne Aerobiological Sampling," *Journal Environmental Health*, pp. 51-53, July/August 1972 (*et al.*)

"Physiological and Ecological Studies of *Sphaerotilus natans* in Activated Sludge," National Science Foundation, 4/70-8/71, principal investigator

"Environmental Management of Solid Waste," US Environmental Protection Agency, 7/70-9/73, principal investigator

"PCB's and Other Compounds in Groundwater," US Environmental Protection Agency, 9/72-9/73, principal investigator

Member, American Society for Microbiology
Member, Sigma Xi
Member, Oklahoma Academy of Science; Member, Aquatic Ecology Committee

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JIM F. HARP
Associate Professor
Civil Engineering and Environmental Science Department
1963

BS	University of Arkansas	Industrial Engineering	1955
MS	University of Arkansas	Engineering Mechanics	1959
PhD	University of Arizona	Civil Engineering	1963

Fluid mechanics; hydrology, groundwater; engineering mechanics; engineering science systems analyses

100% (75% teaching, 25% research)

"A Multiphasic Component Study to Predict Storm Water Pollution from Urban Areas," Final Report with AVCO Economic Systems Corporation, Office of Water Resources Research, December 1970 (*et al.*)

"A Dimensionless Parameter Study of Groundwater Recharge," Phase II, OURI Bulletin No. 1820, OURR A-039 Oklahoma, June 1972

"An Innovation Automatic Stream Gaging Method," *Journal of Hydrology*, Amsterdam, Netherlands, North Holland Publishing Company, in press

"Investigation of the Design of Hydraulic Structures and Hydrologic Parameters on Small Watersheds," State of Oklahoma Department of Highways, 2/67-2/68, principal investigator

"A Dimensionless Parameter Study of Groundwater Recharge in Oklahoma," Office of Water Resources Research--Phase I, 6/70-6/71, principal investigator

A Continuation of A-027-OKLA, "A Dimensionless Parameter Study of Groundwater Recharge in Oklahoma," Office of Water Resources Research--Phase II, 6/71-6/72, principal investigator

Registered professional engineer: Oklahoma and Arkansas

Member, American Society of Civil Engineers
Member, American Society for Engineering Education

DAN E. GUYER
Assistant Professor
Civil Engineering and Environmental Science Department
1953

BS	Oklahoma A & M College	-	1949
MS-MPH	University of Oklahoma	-	1952

Milk and food and environmental sanitation

100% (25% teaching, 75% university health services)

Registered professional sanitarian: Oklahoma

Previous full-time professional experience: 3 yrs. (government)

President-Elect, University of Oklahoma Professional Employees Association
Past Consultant, World Health Organization, West Indies
Travel Fellowship, World Health Organization, Summer 1969 to Middle East, Africa, Switzerland, and Great Britain
Diplomate, American Intersociety Academy for Certification of Sanitarians

JOE W. KEELEY
Professor
Civil Engineering and Environmental Science Department
1943

BS	University of Oklahoma	Civil Engineering	1930
MS	University of Oklahoma	Civil Engineering	1946

Transportation engineering, soil mechanics, foundation engineering

100% (teaching)

"Hydrology of Oklahoma Watersheds," Oklahoma Department of Highways, 1952

"Erosion and Erosion Control Devices in Roadway Channels," US Bureau of Public Roads, 1961

"Field Study of Erosion Control Devices in Oklahoma," Federal Highway Administration, 1969

Registered professional engineer: Oklahoma

Member, Highway Research Board

Students

ENROLLMENT

		68-69		69-70		70-71		71-72		72-73	
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT
Civil Engineering	Master's	10	3	10	4	12	3	11	2	14	3
	Doctoral	8	0	8	0	9	0	10	0	16	0
Environmental Science	Master's	30	10	33	12	30	10	35	8	30	7
	Doctoral	4	0	5	0	5	0	6	0	7	0

GRADUATES

		68-69	69-70	70-71	71-72	72-73
Civil Engineering	Master's	8	11	11	14	13
	Doctoral	4	5	5	6	5
Environmental Science	Master's	3	19	22	26	29
	Doctoral	17	2	4	6	7

NON-US NATIONALS

Civil Engineering	Master's	5
	Doctoral	8
Environmental Science	Master's	6
	Doctoral	2

SUPPORT

	Civil Engr.		Envir. Science	
	Master's	Doctoral	Master's	Doctoral
EPA traineeship	6	0	10	0
Other traineeship	5	5	0	4
EPA doctoral fellowship	0	0	0	1
Research assistantship	8	8	1	2
Teaching assistantship	0	0	0	1
Industrial fellowship	1	1	2	1
Government employer	3	1	2	2
Industrial employer	0	1	2	1
Self-supported	1	0	19	1
Consulting	15	15	0	0
R & D	5	10	0	0
Industry	10	15	10	15
Federal government	25	25	35	35
Other government	15	0	30	15
Academic	15	25	10	35
Further study	10	0	15	0
Military	5	10	0	0

Facilities

Research equipment possessed by the school includes complete laboratory facilities for physical, chemical, biological, and radioactive analyses of water, wastewater, air, and gases in addition to a specially designed clean room for aerosol research and a gas test chamber. The facilities available also include a remote access to an IBM 360/50 computer on the campus. A completely equipped 8x40-foot laboratory trailer is used for field studies in water and wastewater problems in remote areas. A talk-back closed circuit television system is available for course instruction.

Oklahoma State University

Stillwater, Oklahoma

Bioenvironmental Engineering Program
School of Civil Engineering
College of Engineering

1891

Environmental Engineering

ECPD Accredited--Civil Engineering

Dr. Anthony F. Gaudy, Jr., Chairman
Bioenvironmental Engineering Group
School of Civil Engineering
Oklahoma State University
Stillwater, OK 74074
(405) 372-6211 x7040

May 1973

The program stresses the development, use, and re-use of the water resource with important interfaces with air pollution control and abatement of pollution from solid wastes. Graduate programs are offered which prepare engineers for professional careers at both the research and practicing levels. Each student's schedule of courses is tailored to his individual needs and background, and all students must actively engage in research and/or investigative activities under faculty guidance during their academic tenure. The areas in which most students in the program specialize are water pollution control and water quality, or water resources planning and development. The water pollution control and water quality aspects of the program are biologically oriented, and the student is provided with an excellent opportunity to meld the sciences of biochemistry and microbiology with the mathematics and physics he already has in his background. The program is highly interdisciplinary, and students may select courses in other engineering areas and in basic science areas in addition to courses taught by the bioenvironmental engineering faculty.

Oklahoma State University is a land-grant institution with an enrollment of approximately 20,000, including 3,000 graduate students. Tuition and fees amount to $14 per credit hour for residents of Oklahoma and $44 per credit hour for nonresidents. Oklahoma State University is located in Stillwater, Oklahoma, a city of slightly over 30,000 residents. The large metropolitan areas of Oklahoma City and Tulsa are approximately an hour's drive from Stillwater.

Admission Requirements

(a) 2.7/4 GPA for admission.

(b) GRE is not used as an entrance criterion.

(c) Admission to the Master's program is possible with a GPA of 2.3/4 provided strong recommendations are supplied. The student must obtain a 3.0/4 average in his first semester to receive full graduate standing.

(d) A foreign student must score 500 or better on TOEFL.

(e) Any engineering discipline degree obtained from an accredited institution as well as backgrounds in chemistry, microbiology, and biological sciences is acceptable into the program.

(f) Students with a nonengineering background usually take 9-12 credit hours of courses in addition to those counting toward their degree. These courses include an introductory survey of the environmental field, a functional design course in wastewater and water supply, and a course in hydraulics. An additional course in mathematics is sometimes required, depending upon the student's background.

(g) Letters of recommendation from professors or former employers who are familiar with the student's past performance and can assess his potential should be provided.

(g) In the usual case, students are admitted for study into the doctoral program based upon their performance in courses in an accredited Master's program and upon evaluation of the thesis or report. Students who have received a Master's degree without having had investigative experience of some kind are usually requested to perform additional predoctoral research.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Bioenvir. Engr.	30-32S	Optional[a]	No	1S	12-18
MCE	30-33S	[b]	No	1S	12-18
PhD	MS+60S	Yes	1[c]	2S	30-36

[a] Either a thesis or formal report. In the great majority of cases, a thesis is completed.

[b] With specialization in bioenvironmental engineering field, a professional practice (6-9S) is required in place of thesis. This may be fulfilled on or off campus, e.g., in industry or government work under joint supervision of a professor and the employment sponsor. The student must write and defend a report on his professional practice investigation or project.

[c] May be replaced by 6S of graduate course work in an area directly related to thesis and must be justified as material which aids the student in his doctoral research.

Course Work

Degree	Title	Instructor	Credits	Last Pres.	Enrollment
CE 3813	Introduction to Sanitary Engineering	Kincannon Sherrard	3S	S'73	60
CE 4813	Hydraulics	DeVries	3S	S'73	26

CE 4823	Sanitary Engineering Design	Kincannon	3S	S'73	25
CE 5813	Sanitary Science	Sherrard Kincannon	3S	F'73	18
CE 5823	City Planning & City Organization	DeVries	3S	Su'72	24
CE 5833	Water Quality Management	Kincannon	3S	F'73	25
CE 5843	Hydrology	DeVries	3S	F'71	12
CE 5853	Bioengineering I	Gaudy	3S	F'73	10
CE 5863	Unit Operations in Bioenvir. Engr.	Kincannon	3S	F'73	15
CE 5873	Air Pollution Control Engineering	Andrews	3S	S'72	10
CE 5923	Water Resources Engineering	DeVries	3S	S'73	26
CE 5953	Biological Waste Treatment Design	Sherrard Kincannon	3S	S'73	11
CE 5913	Groundwater Hydrology	DeVries	3S	Su'72	10
CE 5223	Linear Systems	DeVries	3S	S'73	10
CE 6813	Open Channel Flow & Hydraulic Struc.	DeVries	3S	F'72	30
CE 6823	Bioengineering II	Gaudy	3S	S'73	10
CE 6913	Stream Pollution Control Engineering	Kincannon Gaudy	3S	S'73	12
CE 6923	Industrial Wastes Engineering	Gaudy Kincannon	3S	S'73	10
Chem 3053	Organic Chemistry	Schepple	-	F'72	70
Chem 3153	Organic Chemistry	Dermer	-	S'73	70
Chem 5753	Biochemical Principles	Carraway	-	F'72	75
Chem 5823	Biochemical Lab. Methods	O'Dell	-	S'72	65
Chem 5853	Metabolism	Gholson	-	S'73	75
Chem 6753	Enzymes & Co-Factors	Ebner	-	S'73	20
Micro 3124	Cultivation & Properties of Microorganisms	Gaudy (E. T.)	-	F'72	120
Micro 4123	Virology	Gaudy (E. T.)	-	F'72	55
Micro 5103	Bioenergenetics in Metabolic Pathways	Gaudy (E. T.)	-	S'72	18
Micro 5153	Genetics of Microorganisms	Gaudy (E. T.)	-	S'73	15
Stat 4013	Statistical Methods	McNeill	-	F'72	65

CE 3813, 4813, and 4823 are not offered for graduate credit in the bioenvironmental engineering program. They are, however, courses which are often taken by nonengineering students entering the program.

CE 5813, 5853, 5863, and 5923 are core courses which are strongly recommended to all students studying at the Master's level.

Faculty

ANTHONY F. GAUDY, JR.
Edward R. Stapley Professor of Civil Engineering and
Chairman, Bioengineering and Water Resources
School of Civil Engineering
1961

BSCE	University of Massachusetts	Civil Engineering	1951
MSSE	Massachusetts Institute of Technology	Sanitary Engineering	1955
PhD	University of Illinois	Sanitary Engineering	1959

Bioengineering aspects of pollution control, industrial wastes, response of biological systems to changes in the environment, kinetics and mechanisms of wastewater purification

100% (40% teaching, 60% research)

"Biological Concepts for Design and Operation of the Activated Sludge Process," Project Report for the Water Quality Office, US Environmental Protection Agency, 1971 (with Elizabeth T. Gaudy)

"Biochemical Oxygen Demand," in Water Pollution Microbiology, pp. 305-332, 1972

"Mixed Microbial Populations," in Advances in Biochemical Engineering, II, 1973 (with Elizabeth T. Gaudy)

"Aerobic Digestion of Extracellular Microbial Polysaccharides," Proceedings, 27th Purdue Industrial Waste Conference, 1972 (with Alan W. Obayashi)

"Steady State Model for Activated Sludge with Constant Recycle Sludge Concentration," Biotechnology and Bioengineering, XIII, 1971 (with M. Ramanathan)

"Biological Concepts for Design and Operation of the Activated Sludge Process," US Environmental Protection Agency, 7/70-9/71, principal investigator

"Metabolism of Components of Extended Aeration Activated Sludge," Office of Water Resources Research Institute, US Department of the Interior, 7/71-6/74, principal investigator

"Response of Completely Mixed Activated Sludge Systems to Changes in the Environment," Office of Water Resources Research Institute, US Department of the Interior, 7/71-6/74, principal investigator

Registered professional engineer: Illinois and Oklahoma

Previous full-time professional experience: 6 yrs. (2 yrs. consulting, 2 yrs. industry, and 2 yrs. academic)

Member, AEEP
Member, American Society for Engineering Education; Chairman, Environmental Engineering Division (1971)
Member, Task Force on Pollution Abatement at Military Installations, National Research Council (1972-75)
Director, Association of Environmental Engineering Professors (1973-76)
Member, American Society for Microbiology; Member, Editorial Board (1967-73)
Member, Water Pollution Control Federation; Director (1962-65); Member, Research Committee (1963-72); Member, Standard Methods Committee (1967-date); Member, Awards Committee (1970-73)

RICHARD N. DEVRIES
Associate Professor
School of Civil Engineering
1969

BS	University of Nebraska	Civil Engineering	1958
MS	University of Nebraska	Civil Engineering	1963
PhD	Utah State University	Civil Engineering	1969

Water resources engineering, hydrology, hydraulics, systems analysis, urban planning

100% (60% teaching, 40% research)

"Sensitivity of Groundwater Flow Models to Vertical Variability of Aquifer Constants," Journal American Water Resources Association, in press (with Douglas C. Kent)

"Optimization in Municipal Water Supply System Design," Journal American Water Resources Association, 7, 5, 1971 (with Calvin G. Clyde)

"A Mathematical Model of an Existing Municipal Well Field," Groundwater, Urbana, Illinois, 8, 9, 1970

"Streamflow Simulation Techniques," Proceedings, Oklahoma Academy of Science, December 1969

"Sensitivity of Groundwater Flow Models to Vertical Variability of Aquifer Constants," Office of Water Resources Research Institute, 1971-72, principal investigator

"Environmental Impact Study, Proposed Arcadia Reservoir," US Army Corps of Engineers, 1972-73, co-principal investigator

Registered professional engineer: Nebraska and Oklahoma

Previous full-time professional experience: 10 yrs. (2 yrs. industry, 2 yrs. government, and 6 yrs. academic)

Member, Oklahoma Section American Society of Civil Engineers; Chairman, Tulsa Branch (1973-74)
Member, American Society of Civil Engineers; Chairman, Continuing Education Committee, Hydraulics Division (1972-73)
President, R & J Systems, Inc., Consultants

DON F. KINCANNON
Associate Professor
School of Civil Engineering
1966

BS	Oklahoma State University	Civil Engineering	1959
MS	Oklahoma State University	Sanitary Engineering	1960
PhD	Oklahoma State University	Bioengineering	1966

Biological waste treatment, water quality management, solid waste management

100% (50% teaching, 50% research)

"Organic Concentration and Hydraulic Loading versus Total Organic Loading in Evaluation of Trickling Filter Performance," Water and Sewage Works, 118, 4, 1971 (with E. E. Cook)

"The Hydrocyclone for Solids-Liquids Separation in Biological Systems," Water and Sewage Works, 119, 5, 1972 (with D. B. Hunt and W. G. Tiederman)

"Experimental Design of Hydrocyclones for the Clarification of Waste Water," Proceedings, American Society of Mechanical Engineers Symposium on Flow Studies in Air and Water Pollution, 1972 (with W. G. Tiederman and J. G. Bowen)

"Hydrocyclones for Clarification in Physical-Chemical Waste Water Treatment Systems," US Army Medical Research and Development Command, 1971-72, co-principal investigator

"Solid Waste Collection and Disposal for Rural Areas," part of a National Science Foundation study on Application of Interdisciplinary University Resources to Local Government Problems, 1972, principal investigator

"Resources Planning Studies, Oklahoma-Arkansas, Phase II (Quality)," Office of Water Resources Research Institute, 1970-71, principal investigator

Registered professional engineer: Oklahoma

Previous full-time professional experience: 4 yrs. (1 yr. government and 3 yrs. academic)

Member, Water Pollution Control Federation; Director (1971-74); Chairman, Student Affairs Committee (1973-date)
Member, American Water Works Association; Chairman, Education Committee of Southwest Section
Instructor for Emergency Planning Workshop

JOSEPH H. SHERRARD
Assistant Professor
School of Civil Engineering
1972

BS	Virginia Military Institute	Civil Engineering	1964
MS	Sacramento State College	Civil Engineering	1969
PhD	University of California-Davis	Civil Engineering	1971

Biological wastewater treatment, water treatment, hydraulics

100% (50% teaching, 50% research)

"Relationship between the Observed Cell Yield Coefficient and Mean Cell Residence Time in the Completely Mixed Activated Sludge Process," Water Research, 6, p. 1039, 1972 (with E. D. Schroeder)

"Mathematical and Operational Relationships for the Completely Mixed Activated Sludge Process," Proceedings, 24th Oklahoma Industrial Waste and Advanced Water Conference, 1973 (with E. D. Schroeder and A. W. Lawrence)

"Trickling Filter versus Activated Sludge--When to Select Each Process," Proceedings, 28th Annual Purdue Industrial Waste Conference, 1973, in press (with D. F. Kincannon)

Member, Water Pollution Control Federation; Member, Subcommittee on Wastewater Treatment Plant Design (1973-date)

ELIZABETH THOMAS GAUDY
Professor, Microbiology Department
College of Arts and Sciences
PhD University of Illinois Microbiology 1962
Microbial physiology, response to the environment, microbial genetics, virology
25%

ROBERT K. GHOLSON
Professor, Biochemistry Department
College of Agriculture
PhD University of Illinois Chemistry 1959
Enzymology, biochemical genetics, microbial hydrocarbon degradation, enzymatic removal of oil slicks
10%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Bioenvironmental	Master's	11	-	14	-	18	-	25	-	22	*	ENROLLMENT
Engineering	Doctoral	11	-	9	-	5	-	6	-	8	*	

		68-69	69-70	70-71	71-72	72-73	
Bioenvironmental	Master's	6	6	6	7	13	GRADUATES
Engineering	Doctoral	7	4	3	3	1	

Bioenvironmental	Master's	4	NON-US NATIONALS
Engineering	Doctoral	4	

	Master's	Doctoral	
EPA traineeship	12	3	SUPPORT
Research assistantship	6	5	
Teaching assistantship	2	0	
Self-supported	2	0	
Consulting	20	15	EMPLOYMENT (%)
R & D	14	15	
Industry	14	10	
Federal government	30	10	
Other government	8	20	
Academic	14	30	

*Approximately 30 students are enrolled on a part-time basis through the Oklahoma State University Engineering Extension Co-op Center of the University of Tulsa.

Facilities

Over 6,000 square feet of laboratory space are contained in ten laboratories located in the Engineering Building (Engineering South); analytical laboratories suitable for a variety of student-faculty projects are available. Also included is a laboratory setup especially for pure culture microbiological work. Some of the pilot plant equipment is set up in the fluids laboratory. Ample analytical and electronic equipment for biological, physical, and chemical graduate training and research are available. Fluidized and fixed-bed reactor pilot plants and a simulated receiving stream are also available for use in the program. The engineering computer facility located in Engineering South is readily accessible. The University Computer Center is located nearby, and the University Library is adjacent to the labortory building.

Oregon State University

Corvallis, Oregon

Civil Engineering Department
School of Engineering

Sanitary Engineering

ECPD Accredited--Civil Engineering

Dr. F. D. Schaumburg, Head
Department of Civil Engineering
Apperson Hall
Oregon State University
Corvallis, OR 97331

May 1973

The sanitary engineering graduate program at Oregon State University is administered through the Department of Civil Engineering. The major area of emphasis in the program is water quality; however, the students can elect minor options in air quality, solid wastes, water resources, hydraulics, ocean engineering or a number of other areas. The water quality program places special emphasis on unit operations, water quality analysis, and wastewater treatment. Both the MS and PhD degrees are obtainable through this program.

Oregon State University is both a land-grant and a sea-grant institution. The total enrollment is approximately 15,000 with nearly 2,000 students enrolled in the School of Engineering. The Civil Engineering Department generally has an enrollment of 500 students of which 50-75 are graduate students. The sanitary engineering graduate enrollment ranges from 15-25 students per year.

Oregon State University has very strong supporting areas in oceanography, forestry, and fisheries and wildlife. The Northwest Regional Laboratory of the US Environmental Protection Agency is also located adjacent to the campus. Interchange of faculty and students with EPA staff is encouraged. The University features active involvement in interdisciplinary research through numerous institutes and study centers situated on the campus.

Oregon State University is situated in an ideal location for the outdoors-minded student. The Pacific Ocean (and University Marine Science Center) is a short 50 miles to the west of the campus; the spectacular Cascade Mountain Range and excellent ski slopes are within an hour and a half drive to the east and excellent fishing, hunting, and camping are available within minutes from the campus. Even though the air may be on the wet side during the winter, it is pure and fresh the year around.

Admission Requirements

(a) 2.75/4 or equivalent for last two years of college.

(b) GRE is not required.

(c) Provisional admission is possible, refer to Graduate Bulletin for details.

(d) A score of 500 on TOEFL is required for admission of foreign students.

(e) Any engineering discipline and some science majors are acceptable; however, some engineering science courses may be required as prerequisites for nonengineers.

(f) Generally mathematics through differential equations, fluid mechanics, and hydraulics.

(g) Acceptance by major department is necessary for admission.

(h) Background is more critically examined for PhD candidates. Also, letters of recommendation from previous professors are required.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	45Q	[a]	No	3Q	12
PhD	Varies	Yes	Yes	12 mos.	36-48

[a] Thesis or project.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 540	Sanitary Engineering Processes	Schaumburg	-	A'72	20
CE 541	Sanitary Engineering Processes	Schaumburg	-	W'73	22
CE 542	Sanitary Engineering Processes	Wicks	-	A'73	16
CE 543	Water Quality Studies	Phillips	-	Su'71	15
CE 544	Water Quality Analysis	Phillips	-	A'72	22
CE 545	Water Quality Analysis	Miner	-	W'73	22
CE 546	Water Quality Analysis	Schaumburg	-	S'70	8
CE 547	Industrial Wastes	Phillips	-	S'72	15
CE 548	Water Quality Dynamics	Bella	-	W'73	30
CE 549	Sanitary Engineering Design	Phillips	-	S'73	15
CE 588	Advanced Wastewater Treatment	Phillips	-	S'73	15
CE 412(G)	Hydraulics	Sollitt	-	W'73	16
CE 526	Open Channel Flows	Montes	-	S'73	10
CE 527	Hydrology	Klingeman	-	W'72	8
CE 525	River Control & Utilization	Klingeman	-	S'72	10
ME 590	Fundamentals of Air Sanitation	Boubel	-	A'72	-
ME 591	Measurement & Control of Air Poll.	Boubel	-	W'73	-
ME 592	Measurement & Control of Air Poll.	Boubel	-	S'73	-
ME 593	Selected Topics in Air Sanitation	Boubel	-	W'73	-

ME 595	Industrial Hygiene	Boubel	-	S'73	-
FSH 470(G)	Water Pollution Biology	-	-	-	-
FSH 570	Pollution in Fisheries	-	-	-	-
BB 450	General Biochemistry	-	-	-	-
BB 451	General Biochemistry	-	-	-	-
BB 452(G)	General Biochemistry	-	-	-	-
STAT 456	Statistics	-	-	-	-
STAT 457(G)	Statistics	-	-	-	-

Faculty

DAVID ANDREW BELLA
Associate Professor of Civil Engineering
Department of Civil Engineering

BS	Virginia Military Institute	-	1961
MS	New York University	-	1964
PhD	New York University	-	1967

Mathematical modeling and eutrophication

100% (30% teaching, 70% research)

"New Concepts in Environmental Planning," Proceedings, 2nd Annual Ocean Engineering Conference, Oregon State University, March 1972, in press

"A Mathematical Model of Nutrient Dynamics of Phytoplankton in a Nitrate Limited Environment," Proceedings, 8th Annual American Association of Professors in Sanitary Engineering Workshop on Mathematical Modeling in Environmental Engineering, December 1972

"Tidal Flats in Estuarine Water Quality Analysis," First Annual Progress Report, Engineering Experiment Station, Oregon State University, September 1969

"Tidal Flats in Estuarine Water Quality Analysis," Second Annual Progress Report, Engineering Experiment Station, Oregon State University, December 1970

"Subtle Aspects of Ecosystem Management," Technology and Management of the Environment, Water Resources Research Institute, Oregon State University, May 1971

Previous full-time professional experience: 1 yr. (government)

RICHARD W. BOUBEL
Professor of Mechanical Engineering
1954

BS	Oregon State University	-	1953
MS	Oregon State University	-	1954
PhD	University of North Carolina	-	1963

Air pollution control

100% (50% teaching, 50% research)

"Emissions from Burning Grass Stubble and Straw," Journal Air Pollution Control Association, 19, 7, pp. 497-500, July 1969 (with W. F. Darley and E. A. Schuck)

"Effectiveness of a Fluidized Bed in Removing Submicron Particles from an Air Stream," Industrial and Engineering Chemistry Process Design and Development, 8, 4, October 1969

"Emission Sampling from Grass Burning," Proceedings, 12th Conference on Methods in Air Pollution Southern California, April 1971

"A High Volume Stack Sampler," Journal Air Pollution Control Association, 21, 12, December 1971

Diplomate, AAEE
Member, American Society of Mechanical Engineers
Member, American Society for Engineering Education
Member, Air Pollution Control Association; Member, National Program Committee; Regional Vice President; Board of Directors; Editorial Review Committee; Regional President (1969-70)

FRED J. BURGESS
Professor and Dean of Engineering
1953

BS	Oregon State University	-	1950
MS	Harvard University	-	1955

Wastewater treatment

100% (10% teaching, 10% research, 80% administration)

"Pulp Mill Outfall Analysis by Remote Sensing Techniques," Technical Association of the Pulp and Paper Industry, 54, 3, March 1971 (with W. P. James)

"Pulp Mills Take to the Air to Monitor Ocean Outfalls," Pulp and Paper, pp. 66-68, September 1970 (with W. P. James)

"Monitoring of Waste Dispersion from Ocean Outfalls by Aerial Photogrammetry," Oregon State University Engineer, 6, 2, January 1971

"Engineering Education in Oregon," School of Engineering, Miscellaneous Report Series, pp. 1-100, April 1972

Previous full-time professional experience: 3 yrs. (government)

Chairman, US Public Health Service, National Environmental Health Training Committee
Member, Environmental Science and Engineering Study Section, National Institutes of Health
Member, US Public Health Service, Division of Water Supply and Pollution Control Training and Demonstration Grant Committee (1962-64)
Individual Achievement Award, Pollution Control Association (1962)
Member, National Academy of Sanitary Engineers

PETER C. KLINGEMAN
Associate Professor of Civil Engineering
1966

BS	Northwestern University	-	1957
MS	Northwestern University	-	1959
PhD	University of California-Berkeley	-	1965

Applied hydrology and water resources development, river and coastal hydraulics, sediment transport

100% (30% teaching, 70% research)

Environmental Consideration and the Water Resources of the Silvies Basin, Oregon State University, Water Resources Research Institute, Report No. WRRI-6, 1971 (et al.)

Studies on Effects of Watershed Practices on Streams, US Environmental Protection Agency Water Pollution Control Research Series 13010 EGA 02/71, Oregon State University, February 1971 (with Krygier and Brown)

"Prediction of Pier Scour in Western Oregon," report submitted to Federal Highway Administration, US Department of Transportation, Region 8, Portland, Oregon, 1971

Hills Creek Reservoir Turbidity Study, Oregon State University, Water Resources Research Institute, Report No. WRRI-14, 1971 (et al.)

"Hydrologic Aspects of Bridge Pier Scour Design in the Pacific Northwest," presented at 19th Annual Pacific Northwest Regional Meeting, American Geophysical Union, Vancouver, British Columbia, Canada, October 1972

Previous full-time professional experience: 3 yrs. (academic)

Member, Phi Eta Sigma
Member, Tau Beta Pi
Special Recognition as "Professor Extraordinario" by the Fundacion de Ingenieros de la Universidad Catolica de Chile
Member, American Society of Civil Engineers
Member, American Geophysical Union

J. RONALD MINER
Associate Professor of Agricultural Engineering
1972

BSE	University of Kansas	Chemical Engineering	1959
MSE	University of Michigan	Sanitary Engineering	1960
PhD	Kansas State University	Chemical Engr. & Bacteriology	1967

Water chemistry and animal science

100% (20% teaching, 80% research)

"Waste Environment Complex in Confinement Production of Swine," *Proceedings*, 7th International Congress of Agricultural Engineering, Baden, Germany, pp. 197-203, 1969 (with T. E. Hazen)

"Treatment of Livestock Lagoon Effluent by Soil Filtration," *Proceedings*, International Symposium on Livestock Wastes, pp. 329-333, 1971 (*et al*.)

"An Evaluation of Three Hydraulic Manure Transport Treatment Systems, Including a Rotating Biological Contactor, Lagoons, and Surface Aerators," *Waste Management Research Procaedings*, 1972 Cornell Agricultural Waste Management Conference, pp. 271-288, 1972 (with H. L. Pearson)

"Automated Hydraulic Waste-Handling System for a 700-Head Swine Facility Using Renovated Water," *Waste Management Research Proceedings*, 1972 Cornell Agricultural Waste Management Conference, pp. 249-262, 1972 (*et al*.)

"Storage of Manure Solids by Forming Soil-Manure Pellets," *Waste Management Research Proceedings*, 1972 Cornell Agricultural Waste Management Conference, pp. 201-210, 1972

Previous full-time professional experience: 8 yrs. (4 yrs. academic and 4 yrs. government)

Member, Sigma Xi
Member, Gamma Sigma Delta

J. SERGIO MONTES
Assistant Professor of Civil Engineering

CE Degree	University of Chile (Santiago)	Civil Engineering	1961
PhD	Massachusetts Institute of Technology	-	1972

Hydraulics, fluid mechanics

100% (50% teaching, 50% research)

"El Escurrimiento Sobre la Entroda de Vertederos en Pared Gruesa con Arista Viva" ("Flow on the Entrance Section of Sharp Entry, Broad Crested Weirs"), 2nd Latin-American IAHR Congress, Caracas, Venezuela, 1966

"Una Nueva Teoria Sobre el Escurrimineto en Canales Abiertos con Rugosidad Artificial" ("A New Theory of Flow in Open Channels with Artificial Roughness"), 3rd Latin-American IAHR Congress, Buenos Aires, Argentina, 1968

"Un Esquema Formal de Distribucion de Velocidodes en Tuberias Circulares Lisas" ("A Formal Scheme of Velocity Distribution in Smooth Round Pipes"), 4th Latin-American IAHR Congress, Mexico City, 1970

"Flow Over Round Crested Weirs," L'Energia Elettrica, Milan, Italy, December 1969

"Interaction of Two Dimensional Turbulent Flow with Suspended Particles," Ralph M. Parsons Laboratory, Massachusetts Institute of Technology, TR 164, January 1973 (with A. T. Ippen)

Previous full-time professional experience: 6 yrs. (2 yrs. research and 4 yrs. academic)

DONALD D. PHILLIPS
Professor in Civil Engineering
1961

BS	Washington State University	-	1944
MS	Louisiana State University	-	1958
PhD	University of Wisconsin	-	1963

Water chemistry, solid wastes, advanced waste treatment

100% (90% teaching, 10% research)

"Some Aspects of the Metabolism of a Partially Colloidal Substrate," Biotechnology and Bioengineering, X, pp. 189-213, 1968 (with R. H. Berg)

"Chlorine Disinfection in Final Settling Basins," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SA2, April 1972 (with D. W. Monroe)

Member, American Society of Civil Engineers
Member, Water Pollution Control Federation
Member, Sigma Xi
Member, Sigma Tau

FRANK D. SCHAUMBURG
Associate Professor of Civil Engineering and Department Head
1967

BS	Arizona State University	-	1961
MS	Purdue University	-	1964
PhD	Purdue University	-	1966

Biological treatment and industrial waste control

100% (20% teaching, 15% research, 65% administration)

"A New Concept in Sample Preservation--Poisoning and Depoisoning," Journal Water Pollution Control Federation, August 1971

"Bark Debris from Log Unloading Operation," Pulp and Paper, in press (with K. Williamson)

"The Character and Treatability of Log Pond Waters," Water and Sewage Works, July 1971 (with J. Hoffbuhr and G. Blanton)

"New Process Top Performer on Municipal/Industrial Sewage," Water and Wastes Engineering, October 1971

"Pollutional Impacts of the Proposed Expansion of the Portland International Airport," Final Engineering Report Submitted to Port of Portland, June 1972

Registered professional engineer: Oregon

Previous full-time professional experience: 1 yr. (consulting)

Member, Water Pollution Control Federation
Member, American Water Works Association
Member, Tau Beta Pi
Member, Chi Epsilon
Member, Sigma Chi

LARRY S. SLOTTA
Associate Professor of Civil Engineering and
Director of Ocean Engineering Programs
1962

BS	University of Wyoming	-	1956
MS	University of Wyoming	-	1959
PhD	University of Wisconsin	-	1962

Hydraulics, computer applications, ocean engineering

100% (20% teaching, 60% research, 20% administration)

"Offshore Siting of Thermal-Nuclear Power Plants," presented at the 2nd Thermal Power Conference, Washington State University, October 1971 (et al.)

"Advantageous Use of Nuclear Power Plant Waste Heat," presented at the 2nd Thermal Power Conference, Washington State University, October 1971 (et al.)

"Proceedings of 1971 Winter Seminar: Topics in Ocean Engineering," Ocean Engineering Programs, Engineering Experiment Station Circular No. 41, Oregon State University

"Proceedings of the Technical Conference on Estuaries of the Pacific Northwest," Ocean Engineering Programs, Engineering Experiment Station Circular No. 42, Oregon State University, March 1972

"Ocean Engineering Newsletter," August 1971, January 1972, and August 1972

Member, Sigma Xi
Fulbright Grant for Graduate Study, Technical University, Delft, Holland (1956)
NSF Participant Summer Institute of Fluid Mechanics, Colorado State University (1964)
American Society for Engineering Education-Ford Resident in Engineering Practice with Hydronautics, Inc. (1969-70)

CHARLES KEVIN SOLLITT
Assistant Professor of Civil Engineering
1972

BS	University of Washington	-	1966
MS	University of Washington	-	1969
PhD	Massachusetts Institute of Technology	-	1972

Fluid mechanics and measurements, hydrodynamics, coastal engineering

100% (20% teaching, 80% research)

"Wave Attenuation by a Porous Walled Breakwater," Journal Waterways and Harbors Division, 96, WW3, August 1970 (with E. P. Richey)

"Wave Transmission through Permeable Breakwater," Proceedings, 13th International Conference on Coastal Engineering, American Society of Civil Engineers, Vancouver, British Columbia, July 1972 (with R. H. Cross)

"Pneumatic Destratification of Density Layers," Fisheries Research Papers, 3, 2, Washington Department of Fisheries, 1970 (with E. P. Richey)

"Wave Transmission by Overtopping," Technical Note No. 15, Ralph M. Parsons Laboratory, Massachusetts Institute of Technology, July 1971

"Wave Reflection and Transmission at Permeable Breakwaters," Technical Report No. 147, Ralph M. Parsons Laboratory, Massachusetts Institute of Technology, March 1972

Member, Chi Epsilon
Member, Sigma Xi
Member, American Society of Civil Engineers

CHARLES E. WICKS
Professor and Head
Department of Chemical Engineering
1954

BSChE	Oregon State University	Chemical Engineering	1950
MSChE	Carnegie Institute of Technology	Chemical Engineering	1952
PhD	Carnegie Institute of Technology	-	1954
Post Doctorate	University of Wisconsin	-	1961

Chemical unit operations, advanced wastewater chemistry, transport phenomena, mass transfer operations

100% (30% teaching, 15% research, 55% administration)

"Transpirational Heat Transfer from a Cylinder in Cross-Flow Including Effects of Turbulent Intensity," Chemical Engineering Progress Symposium Series, 64, 82, 1968 (with E. Elzy)

Fundamentals of Momentum, Heat and Mass Transfer, John Wiley and Sons, 1969 (with J. R. Welty and R. E. Wilson)

"Dependence of the Diffusion Coefficient on Composition in Binary Gaseous Systems," *Journal Chemical and Engineering Data*, *13*, 4, October 1968 (with R. V. Mrazek and K. N. S. Prabhu)

"Mathematical Model of Multipoint, Internal Oxidation of n-Hexadecane by an Arthrobacter Species," *Bacteriological Proceedings*, 1970 (with F. A. Henning and D. A. Klein)

"Modeling of Microbial Hydrocarbon Transformation by Use of Enzyme Decay and Oxidation Intermediate Gradient Terms," *Bacteriological Proceedings*, 1971 (with F. A. Henning and D. A. Klein)

Member, Tau Beta Pi
Member, Sigma Xi
Member, Phi Lambda Upsilon
National Science Foundation Science Teacher Fellow (1960-61)
E. I. du Pont "Year-in-Industry" Award (1964)

KENNETH J. WILLIAMSON
Assistant Professor of Civil Engineering
1973

BS	Oregon State University	Sanitary Engineering	1968
MS	Oregon State University	Sanitary Engineering	1970
PhD	Stanford University	Environmental Engineering	1973

Biological waste treatment

100% (50% teaching, 50% research)

Students

	68-69		69-70		70-71		71-72		72-73		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master's	7	0	7	0	16	0	13	0	16	0	ENROLLMENT
Doctoral	-	-	2	1	1	-	2	1	1	-	
Master's	2		7		5		12		9		GRADUATES
Doctoral	-		1		-		1		-		
Master's	2		NON-US NATIONALS								
Doctoral	1										

	Master's & Doctoral	
Consulting	15	
R & D	3	
Industry	10	
Federal government	41	EMPLOYMENT (%)
Other government	17	
Academic	5	
Further study	7	
Unknown	2	

Facilities

Training facilities available to the sanitary engineering program consist of those of the Civil Engineering Department together with the availability of facilities of cooperating departments. In addition, the University's Nuclear Center, Computer Center, Marine Science Center, and other general facilities are available as required.

Sanitary engineering facilities consist of approximately 6,000 square feet of space which is divided into a general apparatus and unit operations laboratory of 1,800 square feet, a general classroom and storage area of 1,200 square feet, a graduate research laboratory of 7,000 square feet, and a graduate sanitary chemistry laboratory of 650 square feet, an instrument laboratory plus graduate student and staff offices. The laboratories are furnished with separate benches for analytical determinations and amply equipped with modern instrumentation. In addition, the University has constructed a Water Research Demonstration Laboratory adjacent to the new City of Corvallis Sewage Treatment Plant. This laboratory is 1,800 square feet in area and houses facilities for pilot plant set up and analytical measurements necessary for water research demonstration projects involving graduate students.

A new Environmental Fluid Dynamics Laboratory is currently under construction on the campus. This facility will feature a 344 ft. long x 12 ft. wide x 15 ft. deep wave tank capable of generating 5 foot waves. The facility is to be operational by March 1973.

The Pennsylvania State University

University Park, Pennsylvania

Civil Engineering Department
College of Engineering

Sanitary Engineering
Environmental Pollution Control

ECPD Accredited--Undergraduate Sanitary (Environmental) Engineering

Dr. John B. Nesbitt
Sanitary Engineering
116 Sackett Building
Pennsylvania State University
University Park, PA 16802
(814) 865-8391

Dr. William J. Moroz
Environmental Pollution Control
226 Chemical Engineering Building
Pennsylvania State University
University Park, PA 16802
(814) 865-1415

April 1973

The purpose of the environmental engineering graduate program at Penn State is to prepare students for work in the areas of water quality management, air pollution control, and solid waste management. A separate program in the abatement of noise is available in another department of the University. The degrees offered in sanitary engineering are MS, MEngr, and PhD and in environmental pollution control include MS, MEngr, and MEPC.

The environmental pollution control degrees are administered entirely by the Civil Engineering Department. Admission to and satisfactory completion of the program leading to these degrees is determined by the Department. The environmental pollution control program is an interdisciplinary one (university wide) operating through a coordinating and admissions committee and a group of participating departments. A candidate for an environmental pollution control degree must be accepted by both a participating department and the environmental pollution control committee. These same groups will certify satisfactory completion of the program. Many engineering and science departments are participating in this program.

Penn State is a typical land-grant institution including ten colleges and a graduate school. The enrollment at the main campus at University Park is about 29,000 with 5,000 graduate students. Associated with the University is the Water Resources Research Institute and the Center for Air Environment Studies. Tuition and fees for full-time students for a calendar year are approximately $1,200 for residents of Pennsylvania and $2,750 for nonresidents.

Penn State is located in the mountains of central Pennsylvania in the town of State College (population 30,000). Opportunities for cultural activities and both summer and winter sports are numerous.

Admission Requirements

(a) 2.5/4 for engineers in junior-senior year; 3.0/4 for nonengineers in junior-senior year.

(b) GRE is not required.

(c) Provisional admission as an adjunct student is possible for engineering students with strong recommendations and appropriate work experience. Student must make a grade no less than B in three courses (9 credits) for full admission.

(d) Foreign students must obtain a minimum TOEFL score of 550.

(e) Students with backgrounds in civil engineering, chemical engineering, other engineering disciplines, and science are admissible to the sanitary engineering program as well as to the environmental pollution control program.

(f) Engineering students from disciplines other than civil engineering or chemical engineering must complete courses in fluid mechanics and applied hydraulics as prerequisites for the sanitary engineering program. Science majors must include courses to satisfy ECPD requirements for an engineering degree (i.e., 1/2 year math, 1/2 year basic science, 1 year engineering science, 1/2 year analysis, synthesis, and design). Students enrolling in the environmental pollution control program must have mathematics through ordinary differential equations as well as college level inorganic chemistry and physics.

(g) Two letters of recommendation are required in order for an applicant to be considered for financial aid.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Sanitary Engr.	30S	Yes	No	20S	12
MEngr--Sanitary Engr.	30S	Report	No	20S	12
MS--Envir. Poll. Control	30S	Yes	No	20S	12
MEngr--Envir. Poll. Control	30S	Report	No	20S	12
MEPC	30S	Optional	No	20S	12
PhD--Civil Engr.	60S	Yes	1	3 terms	42

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
ME 405	Small Particle Technology	Heinsohn	3S	F'73	-
ME 470	Intro. to Air Pollution Control	Moroz	3S	S'73	-
METEO 473	Intro. to Micro Meteorology	Panofsky	3S	F'73	-
MICRB 400	Intro. to Environmental Microbiology	Unz	4S	S'73	7
CE 476	Solid Waste Management	Regan	3S	F'73	40
NUCE 420	Radiological Safety	Kenny	3S	S'73	-
CE 451	Advanced Hydrology	Rachford	3S	S'73	-
CE 452	Water Resources & Comps	Rachford	3S	Su'73	-

CE 462	Open Channel Hydraulics	Reed	3S	F'73	-
CE 465	River & Waterways Engineering	Reed	3S	S'73	-
CE 498C	Mgt. Water Pollution Control Proc.	Long	3S	S'73	-
CE 551	Hydrologic Investigations	Rachford	3S	S'73	-
CE 564	Hyd. Engineering Design	Reed	3S	F'73	-
GEOL 452	Intro. to Hydrogeology	Parizek	3S	S'73	-
BIOL 410	General Limnology	Cooper	3S	S'73	-
CE 472	Water Pollution Control	Long	3S	F'72	-
CE 571	Water Treatment Theory	Nesbitt	3S	F'73	17
CE 572	Waste Treatment Theory	Long	3S	F'73	18
CE 574	Lab Analysis in Water Pollution Cont.	Nesbitt	3S	F'72	17
CE 575	Advanced Industrial Waste Treatment	Long	3S	F'72	-
CE 577	Treatment Plant Design	Nesbitt Regan	3S	S'73	7
CE 580	Stream & Estuary Analysis	McDonnell	3S	S'73	-
CE 579	Aquatic Microbiology	Unz	3S	F'73	-
EPC 590	Seminar	Staff	1S	S'73	40
BIOCH 401-2	General Biochemistry	-	3S	S'73	-
CHEM 405	Nuclear & Radio Chemistry	-	3S	S'73	-
CHEM 451-2	Physical Chemistry	-	3S	S'73	-
HPA 410	Principles of Public Health Admin.	Hunt	3S	F'72	-
MICRB 417	Epidemiology	-	2S	S'73	-
AGEC 422	Land & Water Resources Policy	Jansma	3S	S'73	-
AG 400	Intro. to Biometry	Bennett	3S	F'73	-
AGEC 505	Advanced Agricultural Statistics	Bennett	3S	S'73	-
CMPSC 402	Principles of Program	-	3S	S'73	-
RPL 400	Principles of Regional Planning	-	3S	S'73	-
IE 405	Linear Programming	-	3S	S'73	-
IE 508,9,10	Operations Research	-	3S	S'73	-
GCHEM 522	Geochem. Agricultural Systems	Langmuir	3S	F'73	-

Students in the environmental pollution control program must take CE 472, 476, ME 470, and 3 credits of EPC 590.

Faculty

JOHN B. NESBITT
Professor
Civil Engineering Department
1953

BS	The Pennsylvania State University	Civil Engineering	1948
MS	Massachusetts Institute of Technology	Sanitary Engineering	1949
ScD	Massachusetts Institute of Technology	Sanitary Engineering	1952

Water and wastewater collection, distribution, treatment, and disposal for municipalities and industry; sanitary chemistry; environmental sanitation

100% (50% teaching, 25% research, 25% administration)

"Waste Water Renovation and Conservation," The Pennsylvania State University, Studies No. 23, University Park, 1967 (et al.)

"Chemical Precipitation of Phosphorus in a High Rate Activated Sludge System," Journal Water Pollution Control Federation, 40, pp. 1239-1267, July 1968 (with W. A. Eberhardt)

"Phosphorus Removal--The State of the Art," Journal Water Pollution Control Federation, 41, pp. 701-713, May 1969

"Soluble Phosphorus Removal in the Activated Sludge Process, Part I: Chemical Biological Process Performance," Government Printing Office, Water Pollution Control Research Series, 17010 EIP 05/71, May 1971 (with D. A. Long and R. R. Kountz)

"Soluble Phosphorus Removal in the Activated Sludge Process, Part II: Sludge Digestion Study," Government Printing Office, Water Pollution Control Research Series, 17010 EIP 10/71, October 1971 (et al.)

"Soluble Phosphorus Removal in the Activated Sludge Process," US Environmental Protection Agency and Soap and Detergents Association, 1969-71, principal investigator

"Combined Treatment of AMD and Municipal Wastewater," Office of Water Resources Research and State of Pennsylvania, principal investigator

"Anthracite Coal as a Filter Medium for Precoat Filters," Small Industries Research, principal investigator

Member, AEEP
Member, American Society of Civil Engineers; Past Chairman, Sanitary (Environmental) Engineering Division
Member, International Association of Water Pollution Research; Member, USA National Committee
Member, Water Pollution Control Association of Pennsylvania; Chairman, Program Committee

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DAVID A. LONG
Assistant Professor
Civil Engineering Department
1964

BS	State University of Iowa	Civil Engineering	1957
MS	State University of Iowa	Sanitary Engineering	1959
PhD	The Pennsylvania State University	Sanitary Engineering	1971

Water and wastewater collection, distribution, treatment, and disposal for municipalities and industry; engineering economy; law

100% (50% teaching, 25% continuing education, 25% administration)

"Some Experiences with Operator Training," Water and Sewage Works, July 1968

"What Price Money?," Journal Water Works Operators Association of Pennsylvania, 39, 1967-68

"Soluble Phosphate Removal in the Activated Sludge Process--A Two Year Plant Scale Study," Proceedings, 26th Purdue Industrial Wastes Conference, May 1971 (in press)

"Soluble Phosphorus Removal in the Activated Sludge Process, Part I," The Pennsylvania State University, August 1971 (with J. B. Nesbitt and R. R. Kountz)

"Soluble Phosphorus Removal in the Activated Sludge Process, Part II: Sludge Digestion Study," The Pennsylvania State University, October 1971 (et al.)

"Soluble Phosphorus Removal in the Activated Sludge Process," US Environmental Protection Agency and Soap and Detergent Association, 1969-71, research assistant

Registered professional engineer: Iowa and Pennsylvania

Previous full-time professional experience: 7 yrs. (2 yrs. teaching, 2 yrs. government, and 3 yrs. consulting)

Member, Water Pollution Control Association of Pennsylvania; President (1973-74)
Member, Governor's Advisory Board on Water Pollution

ARCHIBALD J. MCDONNELL
Associate Professor
Civil Engineering Department
1962

BS	Manhattan College	Civil Engineering	1958
MS	The Pennsylvania State University	Sanitary Engineering	1960
PhD	The Pennsylvania State University	Sanitary Engineering	1963

Water quality, stream and estuarine analysis, water pollution control

100% (25% teaching, 25% research, 50% administration)

"Effect of Environmental Factors on Benthal Oxygen Uptake," Journal Water Pollution Control Federation, 41, pp. 353-363, August 1969 (with S. D. Hall)

"Eutrophication and the Oxygen Economy of Streams," Proceedings, 31st International Water Conference, Engineers Society of Pennsylvania, 31, pp. 3-8, October 1970

"Variations in Oxygen Consumption by Aquatic Macrophytes in a Changing Environment," Proceedings, 14th Conference on Great Lakes Resources, International Association of Great Lakes Resources, pp. 52-58, 1971

"Environmental Impact of Secondary Treatment Plant Effluents," Proceedings, 7th Annual Conference of American Water Resources Association, in press

"Variable Respiration in Aquatic Plant Communities," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SA2, pp. 325-339, April 1972 (with W. D. Weeter)

"Plant Respiration in Streams," US Department of the Interior, Office of Water Resources Research, principal investigator

"Techniques for Evaluating Nutrient Deficiencies in Streams," US Department of the Interior, Office of Water Resources Research, principal investigator

"Agro-Power-Wastewater Complex: Feasibility and Design," National Science Foundation (RANN), co-investigator

Previous full-time professional experience: 1 yr. (consulting)

Member, AEEP
Member, American Society of Civil Engineers; Chairman, Environmental Engineering Division Sessions Program Committee
Director, Water Resources Research Institute, The Pennsylvania State University
Member, Local Sewer Authority

RICHARD F. UNZ
Associate Professor
Civil Engineering Department
1966

BS	Syracuse University	Bacteriology	1957
MS	Syracuse University	Microbiology	1960
PhD	Rutgers University	Environmental Science	1965

Environmental microbiology, environmental sanitation

100% (50% teaching, 50% research)

"The Predominant Bacteria in Natural Zoogloeal Colonies, I: Isolation and Identification," Canadian Journal of Microbiology, 13, pp. 1671-1682, 1967 (with N. C. Dondero)

"The Predominant Bacteria in Natural Zoogloeal Colonies, II: Physiology and Nutrition," Canadian Journal of Microbiology, 13, pp. 1683-1694, 1967 (with N. C. Dondero)

"Fecal Coliforms and Fecal Streptococci in the Bacteriology of Water Quality," Water and Sewage Works Reference Issue, 115, pp. R238-R243, 1968

"Nonzoogloeal Bacteria in Wastewater Zoogloeas," Water Research, 4, pp. 575-579, 1970 (with N. C. Dondero)

"Neotype Strain of Zoogloea Ramigera Itzigsohn: Request for an Opinion," International Journal Syst. Bacteriology, 21, pp. 91-99, 1971

"Biological Treatment of Acid Mine Drainage," US Department of the Interior, Office of Water Resources Research, principal investigator

"Formation of Extra Cellular Slimes by Zooglea Strains," US Environmental Protection Agency, principal investigator

"Slime Infestation in Humidification Systems," Small Industries Research, principal investigator

Previous full-time professional experience: 1 1/2 yrs. (government)

Consultant to three industries
Editor, Journal of the local section of American Society for Microbiology

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RAYMOND W. REGAN
Assistant Professor
Civil Engineering Department
1972

BS	Manhattan College	Chemical Engineering	1965
MS	Manhattan College	Sanitary Engineering	1966
PhD	University of Kansas	Environmental Health Engineering	1972

Solid waste management, environmental pollution control

100% (75% teaching, 25% research)

"Review of the Decomposition of Cellulose and Refuse," Compost Science, 11, 1, January-February 1970 (with J. S. Jeris)

"Is Moisture Content an Important Parameter for Composting?," presented at ANERAC 1970, University of Rhode Island, Kingston, July 1970

"Cellulose Degradation in Compositing," Final Report, US Public Health Service, Solid Waste Program, Research Grant EC00161, January 1971 (with J. S. Jeris)

"Optimum Conditions for Composting," in Wastes (C. L. Mantel, ed.), John Wiley and Sons, New York, in publication (with J. S. Jeris)

"Solid Waste Instrumentation," The Pennsylvania State University, principal investigator

Registered professional engineer: Kansas

Previous full-time professional experience: 5 yrs. (4 yrs. research and 1 yr. consulting)

Consultant to two industries
Chairman, American Society of Civil Engineers, Environmental Engineering Division, Specialty Conference

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THOMAS M. RACHFORD
Assistant Professor
Civil Engineering Department
1969

BS	University of Kentucky	Civil Engineering	1964
MS	University of Kentucky	Sanitary Engineering	1966
PhD	Stanford University	Water Resources	1972

Water resources economics and planning, systems engineering, hydrology

100% (50% teaching, 50% research)

"Time-Capacity Expansion of Wastewater Systems," Journal Sanitary Engineering Division, American Society of Civil Engineers, December 1969 (with R. F. Scarato and T. Tchobaroglous)

"Optimization of Water Resources Allocations by Operational Mathematics," paper presented to Water Year Symposium, Pretoria, South Africa, 1970 (with G. Aron and B. M. Reich)

"Nonlinear Programming and Sensitivity Analysis Applications to Process Analysis and Control," Proceedings, Institute on Urban Water Systems, Colorado State University, May 1970

"Rainfall-Duration-Frequency Relationships in Pennsylvania," Report, Institute for Research on Land and Water Resources, The Pennsylvania State University, June 1970 (et al.)

"Time Distribution of Storm Rainfall in Pennsylvania," Report, Institute for Research on Land and Water Resources, The Pennsylvania State University, June 1971 (et al.)

"Optimum Antecedent Precipitation Indices," Pennsylvania Department of Environmental Resources, US Department of the Interior, Office of Water Resources Research, co-investigator

"Surface and Groundwater Conjunctive Use in the Appalachian States," WRRC and Corps of Engineers, co-investigator

"Agro-Power-Wastewater Complex: Feasibility and Design," National Science Foundation (RANN), co-investigator

Registered professional engineer: Pennsylvania

Previous full-time professional experience: 3 yrs. (1 yr. academic and 2 yrs. government)

Consultant, US Corps of Engineers

WILLIAM J. MOROZ
Professor
Mechanical Engineering
1968

BASc	University of Toronto	Mechanical Engineering	1949
MASc	University of Toronto	Mechanical Engineering	1951
MS	University of Michigan	Meterology	1962
PhD	University of Michigan	Meterology	1965

Air pollution and its control

100% (25% teaching, 25% research, 50% administration)

"The Engineering Approach to Environmental Control," Proceedings, 61st Annual Meeting of the International District Heating Association, 61, pp. 53-56, 1970

"A Portable Counter and Size Analyzer for Airborne Dust," Review Scientific Instruments, 41, 7, pp. 978-983, 1970 (with V. D. Withstandley and G. W. Anderson)

"Plume Rise and Dispersion in a Local Wind System," American Society of Mechanical Engineers Paper No. 70-WA/FU-1, November 1970 (with E. Koczkur)

"Is Noise an Atmospheric Pollutant?," Journal Air Pollution Control Association, 21, 8, p. 460, August 1971 (Form Article)

"A Portable, Battery Operated Immediate Readout Dust-Particle Analyzer," Journal Air Pollution Control Association, 21, 9, pp. 571-573, September 1971 (with V. Withstandley and G. W. Anderson)

"A Study of Particle Agglomeration in the Atmosphere," US Environmental Protection Agency, principal investigator

"Prediction of Pollutant Concentrations in an Urban Atmosphere," US Environmental Protection Agency, principal investigator

"Development and Field Testing of a Particle Counter," Coal Research Board of Pennsylvania, principal investigator

Registered professional engineer: Ontario and Pennsylvania

Previous full-time professional experience: 10 yrs. (7 yrs. industry and 3 yrs. academic)

Executive Committee, Air Pollution Control Division, American Society of Mechanical Engineers Board of Editors, Air Water and Soil Pollution Journal
Member, New York Academy of Science

Students

		68-69	69-70	70-71	71-72	72-73
		FT PT	FT PT	FT PT	FT PT	FT PT
Sanitary Engineering	Master's	- -	- -	18	27	33
	Doctoral	- -	- -	3	3	3
Environmental Pollution Control	Master's	- -	- -	0	3	9
	Doctoral	- -	- -	0	0	0

ENROLLMENT

GRADUATES

Sanitary Engineering	Master's	-	-	4	5	12
	Doctoral	-	-	1	1	1
Environmental Pollution Control	Master's	-	-	0	0	3
	Doctoral	-	-	0	0	0

NON-US NATIONALS

Sanitary Engineering	Master's	1
	Doctoral	1
Environmental Pollution Control	Master's	1
	Doctoral	0

SUPPORT

	Master's	Doctoral
EPA traineeship	7	0
Graduate assistantship	5	3
Employer	1	0
Other government support	1	0
Self-supported	9	0

EMPLOYMENT (%)

	Master's	Doctoral
Consulting	39	0
Government	42	0
Academic	3	50
Further study	3	0
Industry	0	50
Military	3	0
Unknown	10	0

Facilities

Laboratory facilities include 440 square feet for teaching and 4577 square feet for teaching and research. The teaching and research space is divided into a microbiological laboratory, an instrument room, a microbiological preparation room, five chemical laboratories, and a room for pilot plant studies. These rooms contain four walk-in incubators, temperature controlled incubator shakers, water baths, refrigerated centrifuge, microscopes, radiation counting equipment (GM with automatic sample changer, liquid scintillation, vibrating reed electrometer), two gas chromotographs, spectrophotometers (visible light, UV, infra-red, atomic, absorption), analytical balances, oxygen bomb calorimeter, fluorimeter, total and organic carbon analyzer, grinder, bench scale controlled fermentation apparatus, zetameter, three Warburg respirometers, micro and macro Kjeldahl digestion apparatuses, pH meters, specific ion meters, dissolved oxygen analyzers distilling apparatus, drying ovens, combustion furnace, muffle furnaces, and two autoclaves. The Center for Air Environment Studies provides extensive laboratory space for conducting research on air pollution problems. Additional space and equipment is available, at another location, in the Water Resources-Research Institute of the Institute for Research on Land and Water Resources. The University Computation Center and the Brezealle Nuclear Reactor are also available for use.

Polytechnic Institute of New York

Brooklyn, New York*

Department of Civil Engineering

Civil Engineering
Environmental Health Science

Dr. Alan H. Molof
Associate Professor of Civil Engineering
Polytechnic Institute of New York
333 Jay Street
New York, NY 11201
(212) 584-0700 x598

June 1973

The emphasis of the program is water quality engineering which includes water supply, water and wastewater treatment, and the analysis of the effect of discharges on all receiving waters. Supporting the core of this program is a strong minor program in air resources engineering as well as courses in solid waste, environmental health engineering, environmental planning and management. The merging of the two engineering schools provides a broadening with depth of the environmental efforts of both schools.

This program is the only full-time program in the New York City metropolitan area which offers training up to the doctoral and postdoctoral level in the environmental engineering areas of water, air, and solid waste. In addition to the full-time program, there is also a part-time program which allows people with full-time employment to study part-time towards an MS degree. The intermix of both full and part-time students in the classroom and laboratory acts as a stimulant for both types of students. Classes are held in the day and evening.

The site of the major effort is the Brooklyn Campus which is located about five blocks from the Brooklyn Bridge. This bridge spans the East River (part of the Hudson River Estuarine complex) connecting downtown Manhattan with Brooklyn. Due to this location, there is an opportunity to study all types of environmental problems in the classroom, laboratory, and field. Since all levels of government concerned with the environment, local to Federal, have their offices in close proximity, it is possible to more closely follow developments in governmental planning and thinking.

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*Other locations in New York City include Washington Square and Bronx, New York. Other locations outside New York City include Farmingdale, Long Island, New York.

Admission Requirements

(a) 2.5 GPA.

(c) Provisional admission is possible depending on record and references.

(d) Language examinations for foreign students are handled by Foreign Student Office.

(e) All engineering disciplines from an accredited institution are acceptable for an engineering degree. Individuals with degrees in chemistry and biology are acceptable for a degree in environmental health science.

(f) No make-up courses are required for nonengineers. Nonengineers enroll in the environmental health science degree.

(h) Enrollment for courses beyond the Master's degree are handled the same as the pre-Master's degree candidates. Candidacy for doctoral programs is determined by a specifically appointed committee.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engineering	36S	Optional	No	-	9
MS--Envir. Health Science	36S	Optional	No	-	12
PhD	72S	Yes	Yes	2S	42

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
T26.1103	Sanitary Chemistry	Cardenas Molof	3S	[illegible]'72	36
2206	Sanitary Microbiology	Cardenas	3S	F&S'72-73	38
2208	Industrial Waste Treatment	Molof	3S	S'72	28
2211	Water & Wastewater Treatment I	Molof	3S	F'72	46
2212	Water & Wastewater Treatment II	Molof	3S	S'73	43
2215	Environmental Health Engineering	Ingram	3S	F'72	23
2216	Solid Wastes	Ingram	3S	S'73	43
2218	Air Pollution	Ingram	3S	F'72	22
2220	Advanced Hydraulic Pr.	Gidlund Goodman	3S	F&S'72-73	24
2222	Chemistry for Sanitary Engineering	Cardenas	3S	S'73	10
2224	Water & Wastewater Treatment Lab.	Cardenas	3S	S'73	13
2227	Hydrology I	Gidlund Goodman	3S	F'72	48
2228	Hydrology II	Goodman	3S	S'73	11
2229	Water Resource Planning	Goodman	3S	S'73	15
2230	Stream & Estuarine Pollution	Gidlund	3S	S'73	35

T26.1103, 2206, 2211, 2212, 2220, 2227, and 2230 are required for civil engineering majors. T26.1103, 2206, 2211, 2212, 2215, 2218, and 2230 are required for environmental health engineering majors.

Faculty

ALAN H. MOLOF
Associate Professor and Program Director
Civil Engineering
1962

BS	Bucknell University	Chemical Engineering	1949
MSE	University of Michigan	Chemical Engineering	1951
MSE	University of Michigan	Sanitary Engineering	1953
PhD	University of Michigan	Sanitary Engineering	1961

Wastewater treatment, water treatment, monitoring, anaerobic digestion, sanitary chemistry

100% (50% teaching, 30% research, 20% administration)

"Nitrification in the Biological Fixed-Film Rotating Disk System," Journal Water Pollution Control Federation, accepted for publication in 1973 (with C. Weng)

"High Quality Reuse Water from a Newly Developed Chemical-Physical Treatment Process," in Advances in Water Pollution Research (S. H. Jenkins, ed.), Pergamon Press, Oxford, England, p. I-20/1, 1971 (with M. M. Zuckerman)

"Electrode Potential Monitoring and Electrolytic Control in Anaerobic Digestion," Journal Water Pollution Control Federation, 45, p. 655, 1973 (with F. C. Blanc)

"Effect of Benthal Deposits on Oxygen and Nutrient Economy of Flowing Waters," Journal Water Pollution Control Federation, 44, p. 644, 1972 (with J. Fillos)

"The Use of Standards in the Quality Control of Treated Effluents and Natural Waters," in Water and Water Pollution Handbook, Volume III (L. L. Ciaccio, ed.), Marcel Dekker, New York, p. 949, 1971

"Training Program in Water Supply and Water Pollution Control," US Environmental Protection Agency, 1968-date, program director

"Water Treatment for Home Use," Consolidated Foods, 4/73-8/73, project director

"Cation Effects in Anaerobic Waste Treatment," US Environmental Protection Agency, 1965-67, project director

Previous full-time professional experience: 5 yrs. (industry)

Member, AEEP
Member, American Society of Civil Engineers
Member, American Water Works Association
Member, Water Pollution Control Federation
Member, American Chemical Society
Member, Air Pollution Control Association

ERICK RAY GIDLUND
Associate Professor
Civil Engineering
1963

BS	University of Washington	Civil Engineering	1959
PhD	University of Washington	Civil Engineering	1963

Stream and estuary pollution, storm water pollution

50% (45% teaching, 5% research)

"Velocity Profiles and Dispersion in Estuarine Flow," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SA4, p. 647, 1972 (with B. Segall)

"New York Harbor Coliform Density Pollution Study," Proceedings, National Symposium on Estuarine Pollution, Stanford University, p. 755, 1967 (with A. H. Molof and M. Lang)

"Ground Water," to be published in Encyclopedia of Environmental Science (with A. B. Bell)

"Aspects of Characterizing, Predicting and Controlling the Dynamic Response of Urban Hydrological Systems," New York University, 10/71-11/72, thesis advisor

Registered professional engineer: New York

Member, American Society of Civil Engineers; Past Member, Task Force Subcommittee on Outer Space and Ocean Structures; Metropolitan Section Environmental Engineering Group, Member of Executive Committee (Publicity)
Consultant, US Environmental Protection Agency

RAUL R. CARDENAS
Assistant Professor
Civil Engineering
1966

BS	University of Texas	Bacteriology	1951
MS	New York University	Environmental Health Science	1951
PhD	New York University	Environmental Health Science	1970

Sanitary microbiology, sanitary chemistry, laboratory analyses, ecology, water quality

100% (90% teaching, 10% research)

"Scale-Up from Laboratory Activated Sludge and Trickling Filter Units to Prototype Design," Biotechnology and Bioengineering, 8, pp. 389-404, 1966 (with W. W. Eckenfelder)

"Nitrification Studies on a Continuous Flow River Model Using Automated Analysis," Advances in Automated Analysis, Technicon International Congress, II, pp. 285-289, Thurman Associates, Miami, Florida, 1971 (with A. H. Molof)

"Automated Methods in Water Analysis," in Chemical Microbiological Analysis in Water and Water Pollution, Volume IV (L. L. Ciaccio, ed.), Marcel Dekker, New York, 1972 (with L. L. Ciaccio and J. S. Jeris)

"Disposal of Urban Solid Wastes through Composting," presented at 164th National American Chemical Society Meeting, Division of Fertilizer and Soil Chemistry, New York, 1972, in press (with S. Varro)

"An Environmental Case Study Involving a Lake and a Builder," presented at the 8th American Water Resources Conference, St. Louis, Missouri, November 1972 (with B. A. Bell)

"Water Treatment for Home Use," Consolidated Foods, 4/73-8/73, microbiologist

Previous full-time professional experience: 6 yrs. (2 yrs. academic, 3 yrs. research, and 1 yr. industry)

Member, Standard Methods Committee
Senior Science Advisor, Natural Resources Defense Council
Scientific and Technical Merit Reviewer, US Environmental Protection Agency
Expert Witness and Invited Consultant, US Attorney's Office (Southern District, New York, New Jersey)
Fellow, Scientists' Insitute for Public Information

SYED R. QASIM
Associate Professor
Civil Engineering
1971

BS	Muslim University (India)	Civil Engineering	1957
MS	West Virginia University	Civil Engineering	1962
PhD	West Virginia University	Sanitary Engineering	1965

Solid waste management, environmental engineering, water

100%

"Waste Management Systems for Advanced Military Bases," Water and Sewage Works, 1971

"Cost Effectiveness Analysis of Waste Management Systems," Journal Environmental Sciences, 1, 2, 1971

"Process Alternatives Available in Packaged Wastewater Treatment Plants, Water and Sewage Works, 1970

"Leaching from Simulated Landfills," Journal Water Pollution Control Federation, 42, 3, pp. 371-379, 1970

"Leaching of Pollutants from Refuse Beds," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, SA1, pp. 49-58, 1970

Registered professional engineer: Ohio

Previous full-time professional experience: 5 yrs. (3 yrs. research and 2 yrs. industry)

Member, Water Pollution Control Federation
Member, American Society of Civil Engineers
Member, National Society of Professional Engineers
Member, Sigma Xi

ALVIN S. GOODMAN
Professor
Civil Engineering
PhD New York University Civil Engineering 1966
Water resources planning, systems analysis, economic studies
50%

WILLIAM T. INGRAM
Adjunct Professor
Civil Engineering
MPH The Johns Hopkins University Public Health Engineering 1942
Environmental health, solid waste, air pollution
50%
Diplomate, AAEE

PAUL R. DECICCO
Professor
Civil Engineering
MCE Polytechnic Institute of Brooklyn Civil Engineering 1950
Urban planning, environmental systems, sanitary engineering, computer applications
70%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	-	-	-	-	-	-	-	-	18	69	ENROLLMENT
	Doctoral	-	-	-	-	-	-	-	-	2	-	
Environmental Health Science	Master's	-	-	-	-	-	-	-	-	7	12	
	Doctoral	-	-	-	-	-	-	-	-	-	-	
Environmental Engineering	Master's	21		14		22		31		30		GRADUATES
	Doctoral	2		-		3		1		-		
Environmental Health Science	Master's	2		1		3		5		11		
	Doctoral	-		-		1		-		-		

Environmental Engineering	Master's	2	NON-US NATIONALS
	Doctoral	-	
Environmental Health Science	Master's	1	
	Doctoral	-	

	Envir. Engr.		Envir. Health Science		
	Master's	Doctoral	Master's	Doctoral	
EPA traineeship	6	-	1	-	SUPPORT
Teaching assistantship	-	-	1	-	
Industrial support (partial)	2	-	2	-	
Government support (partial)	3	-	4	-	
Self-supported	8	-	-	-	
Consulting	37.3	20	22.7	-	EMPLOYMENT (%)
R & D	0.9	-	-	-	
Industry	4.2	20	40.9	-	
Federal government	11.0	-	4.5	-	
Other government	34.7	-	31.9	-	
Academic	-	60	-	100	
Further study	3.9	-	-	-	
Unknown	8.5	-	-	-	

Facilities

All the normal facilities for environmental programs are available.

Purdue University

West Lafayette, Indiana

Environmental Engineering Area
School of Civil Engineering

Environmental Engineering

ECPD Accredited--Civil Engineering

Dr. James E. Etzel, Head
Environmental Engineering Area
Civil Engineering Building
Purdue University
West Lafayette, IN 47907
(317) 749-2082

May 1973

The programs available in environmental engineering at Purdue University are formulated to provide a sound background in basic engineering design and related sciences which will permit the student to function as a professional person in his selected area of specialization. Basic training or specialization is available in the areas of public health, radiological health, water supply and treatment, air pollution control, solid wastes disposal, and water pollution control. The degrees offered are MSCE, MSE, MS and PhD. The designation of the Master's degree is based upon the undergraduate degree of the candidate.

Purdue University is the land-grant institution of the State of Indiana and has all of the general facilities expected of a major tax-supported institution. It is noted for its schools of engineering, science, and agriculture. Campus enrollment is approximately 30,000 of which approximately 7,500 are graduate students. The environmental engineering program is supplemented on campus by the State of Indiana Water Resources Institute, the Environmental Health Institute, programs in radiological health and bioengineering and a multi-disciplinary Center for Environmental Engineering. Tuition and fees are currently $350 for Indiana residents and $800 for nonresidents per semester.

Purdue University is located on the Wabash River approximately 120 miles from Chicago, and 60 miles from Indianapolis. An interstate highway connects the three points. Purdue University is located on the edge of West Lafayette, a city separated by the Wabash River from Lafayette. The population of the twin cities is approximately 65,000. The campus has a unified rural setting with exceptional recreational and cultural programs. Separate modern dormitories are available for exclusive use of graduate students.

Admission Requirements

(a) 2.8/4 GPA.

(b) GRE is not required except where BS is nonaccredited, for certain fellowships, or to support a weak academic record.

(c) Admissions are governed by Admissions Committee vote. Provisional admissions based on total application materials are possible.

(d) Foreign students must take Purdue diagnostic exam.

(e) Any engineering, physical, or biological science degree is generally acceptable.

(f) Make-up courses, if any, are governed solely by the student's specific selected programs of training. A general knowledge of environmental engineering principles is required.

(g) All candidates must meet the general requirements for graduate study at Purdue University.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS	[a]	Optional[b]	No	2S	12-15
PhD	48+S	Yes	1[c]	2S	[d]

[a] 24S with thesis option; 33S with nonthesis option.

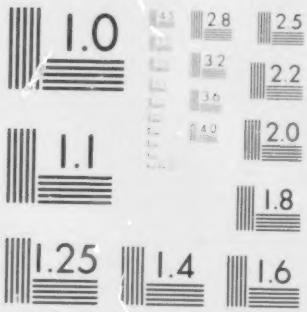
[b] With nonthesis option, a special project is required.

[c] 6S in approved areas may be used as a substitute.

[d] MS + 2 yrs.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 550	Physical Operation in Envir. Engr.	Grady	3S	F'72	20
CE 551	Envir. Engr. & Administration	Wilke	3S	F'72	33
CE 552	Design of Wastewater Treatment Plants	Grady Steffen	3S	F'72	44
CE 553	Design of Water Treatment Plants	Wilke	3S	F'72	16
CE 554	Chemical Analysis of Envir. Engr.	Wolszon	4S	F'72	9
CE 555	Biological Aspects of Envir. Engr.	Kirsch	3S	F'72	25
CE 556	Solid Wastes Disposal	Bell	3S	S'73	45
CE 557	Air Pollution	Jacko	3S	F'72	46
CE 558	Air Sampling & Analysis	Jacko	3S	S'73	20
CE 597[1]	Special Project or Topic	Staff	1-4S	-	-
CE 650	Envir. Radiation Surveillance	Etzel	3S	Su'72	-
CE 651	Advanced Environmental Science	Grady	3S	S'73	7
CE 652	Advanced Environmental Design	Etzel	2S	F&S-72	18
CE 653	Advanced Environmental Lab.	Staff	2-3S	Su'72	-
CE 656	Industrial Waste Disposal	Etzel Steffen	3S	S'73	16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CE 657	Biodegradation of Wastes	Kirsch	3S	S'72	8
CE 697[1]	Special Topics or Project	Staff	1-4S	-	-

[1] All new courses or special topic courses or problems are taught under these numbers. Current listings include: CE 597--Envir. Sampling & Analysis, CE 697--Adv. Air Pollution Control I, and CE 697--Adv. Air Pollution Control II.

There are no required courses. Any course in Purdue University is acceptable for graduate credit if approved by a committee of three faculty members as part of a program acceptable to the Graduate School. Proficiency in chemistry, microbiology, and public health commensurate with professional training objectives is required.

Faculty

JOHN M. BELL
Associate Professor
Environmental Engineering

BSCE	Clarkston College of Technology	-	1957
MSCE	Purdue University	-	1959
PhD	Purdue University	-	1962

Solid waste, wastewater treatment, stream analysis

100% (50% teaching, 40% research, 10% administration)

"Water Quality Simulation Model for the Upper Wabash River," Technical Report No. 34, Water Resources Research Center, Purdue University, January 1973

"Environmental Engineering Teaching Reference Community," Bulletin, School of Civil Engineering, Purdue University, 1971 (with D. L. Brenchley)

"Nitrogen Transformations in Aerobic Digestion of Dairy Cattle Wastes," Proceedings, International Symposium on Livestock Wastes, Columbus, Ohio, 1971 (with A. C. Chang and A. C. Dale)

"Sanitary Landfills," Proceedings, 57th Annual Purdue Road School, 1971

"The Application of Systems Analysis to Water Resources in the Wabash River Basin: A Water Quality Control Dimension of a Water Resources Simulation Model of the Wabash River," Office of Water Resources Research, 7/68-6/71, principal investigator

"The Development of a Mathematical Model for Water Quality Management of the Pearl River, Jackson, Mississippi," Clark, Dietz, and Associates, Inc., 2/72-12/73, principal investigator

"Systematic Development of Methodologies in Planning Urban Water Resources for Medium Size Communities," Title II Grant, Office of Water Resources Research, 9/71-8/74, co-principal investigator

Member, AEEP
Member, Indiana Chapter, American Public Works Association; Chairman, Education Committee (1970-72); Director (1970-71)
Member, Sanitary Engineering Division, American Society of Civil Engineers; Member, Committee on Solid Waste Management (1970-72)
Member, Indiana Water Pollution Control Federation; Member, Industrial Wastes Committee (1968-date)

JAMES E. ETZEL
Professor
Environmental Engineering

BSCE	Pennsylvania State University	-	1951
MSCE	Purdue University	-	1955
PhD	Purdue University	-	1957

Radiological health, tertiary waste treatment, industrial wastes

100% (40% teaching, 40% research, 20% administration)

"Microbial Decomposition of Pentachlorophenol," Journal Water Pollution Control Federation, 45, pp. 359-364, 1973 (with E. J. Kirsch)

"Radiation Treatment of the Organic Fraction of Waste Waters," Transactions of the American Nuclear Society, II, 56, June 1968 (with A. J. Condren)

"One System Treats Sewage, Solid Wastes," Chemistry and Engineering News, 48, 12

"The Lafayette, Indiana Industrial Waste Problems," to be published in Journal Water Pollution Control Federation (with C. F. Niles and J. Morrison)

"The Synthesis and Purification of Pentachlorophenol-14C," Journal Labelled Compounds, 7, pp. 149-153, 1971 (et al.)

Registered professional engineer: Indiana

Member, AEEP
Member, American Society of Civil Engineers
Member, Water Pollution Control Federation

C. P. L. GRADY JR.
Associate Professor
Environmental Engineering

BA	Rice University	-	1960
BSCE	Rice University	-	1961
MS	Rice University	-	1963
PhD	Oklahoma State University	-	1969

Biochemical processes and wastewater treatment, physical operations, modeling and simulation

100% (60% teaching, 30% research, 10% administration)

"Effects of Growth Rate and Influent Substrate Concentration on Effluent Quality from Chemostate Containing Bacteria in Pure and Mixed Culture," Biotechnology and Bioengineering, 14, pp. 391-410, 1972 (with L. J. Harlow and R. R. Riesing)

"A Theoretical Study of Activated Sludge Transient Reponse," Proceedings, 26th Purdue Industrial Waste Conference, pp. 318-335, 1971

"The Use of Final Clarifier Models in Understanding and Anticipating Performance under Operational Extremes," Proceedings, 27th Purdue Industrial Waste Conference, 1972 (in press)

"Evaluation of Activated Sludge Operational Techniques through Laboratory and Computer Analysis," Purdue University In-House Research Grant, 5/73-5/75, principal investigator

"Effects of Dyes on the Anaerobic Digestion of Primary Sewage Sludge," American Dye Manufacturers Institute, 9/71-9/72, co-principal investigator

Member, AEEP
Member, Undergraduate Education Committee and Member, Research Committee, Association of Environmental Engineering Professors

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ROBERT B. JACKO
Assistant Professor
Environmental Engineering

AAS	Milwaukee School of Engineering	-	1960
BSME	Milwaukee School of Engineering	-	1963
MSME	Marquette University	-	1967
PhD	Purdue University	-	1972

Air pollution control engineering

100% (75% teaching, 25% research)

"Prediction of Urban Center Ground Level Air Pollution Concentrations Using Wind Tunnel Models with Comparison to a Gaussian-Type Dispersion Equation," American Society of Civil Engineers Annual Meeting, Houston, October 1972

"A Wind Tunnel Study to Determine the Air Pollution Dispersion Characteristics in an Urban Center," Air Pollution Control Association, Publication #72-137, June 1972

"Emission Parameter Analysis for Cadmium," 1st National Science Foundation Cadmium Conference, Purdue University, July 1972

"Air Pollution Diffusion Modeling in the Urban Center," Fluid Mechanics, Heat and Mass Transfer Forum, Purdue University, December 1972

"Environmental Aspects of Cadmium," National Science Foundation, 1972, principal investigator of stack sampling phase

"Urban Center Air Pollution Dispersion," Public Health Service, 1971, authored

Registered professional engineer: Indiana

Previous full-time professional experience: 6 yrs. (5 yrs. industry and 1 yr. consulting)

Chairman, 12th Annual Purdue Air Quality Conference
Member, Indiana Society of Professional Engineers. AA Potter Chapter; Secretary-Treasurer
Representative of Indiana Gas Utilities as environmental expert witness in Federal Power Commission Court Testimony, Washington, DC, regarding the natural gas shortage
Consultant to various industries

EDWIN J. KIRSCH
Professor
Environmental Engineering

BS	Michigan State University	Bacteriology	1949
MS	Purdue University	Microbiology	1955
PhD	Purdue University	-	1957

Microbiology, environmental science, biodegradation of biocides, immobilized enzymes, microbiology of waste treatment

100% (40% teaching, 40% research, 20% administration)

"Microbial Decomposition of Pentachlorophenol," Journal Water Pollution Control Federation, 45, pp. 359-364, 1973 (with J. E. Etzel)

"Review Article--Anaerobic Digestion in Biological Waste Treatment," in Progress in Industrial Microbiology, 9, pp. 155-237, 1971 (with R. M. Sykes)

"Water Pollution as It Concerns Educators and Their Students," Journal National Association of Biology Teachers, in press

"Accumulation of Methanogenic Substrates in CCl_4 Inhibited Anaerobic Sewage Sludge Digester Cultures," Water Research, 6, pp. 41-55, 1972 (with R. M. Sykes)

"Biodegradation of Pentachlorophenol," Dow, Monsanto, Vulcan, Reichold, Dynamit-Nobel, and Progil Chemical Companies; 1970-date; principal investigator

"Biodegradation of Organothiocyanates," American Cyanamid Company, 1972-73, principal investigator

Member, Society of Industrial Microbiology; Director (1969-71)
Member, Indiana Water Pollution Control Association; Member, Research Committee (chaired twice)
Guest Lecturer, National Biology Teachers

ALFRED JOSEPH STEFFEN
Associate Professor
Environmental Engineering

BSCE	University of Wisconsin	-	1933

Food plant waste prevention, conservation, utilization and treatment organic sludge treatment and disposal; anaerobic treatment processes; water treatment in aerobic and anaerobic lagoons

100% (teaching and counseling)

"Waste Disposal in the Meat Industry; A Comprehensive Review," presented at Meat Industry Research Conference, Chicago, March 1969; published in Proceedings and in Water and Wastes Engineering, March and May 1970

"Waste Disposal in the Meat Industry: US Practices," principal lecture, International Congress on Industrial Wastes, Stockholm, Sweden, October 1970; published in Pure and Applied Chemistry (International Union of Pure and Applied Chemistry), 29, pp. 173-189, 1972

Registered professional engineer: Wisconsin

Previous full-time professional experience: 41 yrs.

Member, AEEP
Member, Water Pollution Control Federation; President (1965-66); Member, Industrial Wastes Committee; Member, Aims and Objectives Committee; Member, Safety Committee
Member, Indiana Water Pollution Control Association; Member, Student Activities Committee; Member, Industrial Wastes Committee
Member, American Society of Civil Engineers
Member, Sigma Xi
Member, Chi Epsilon

HARVEY R. WILKE
Professor
Environmental Engineering

BSCE	University of Missouri	-	1939
MSCE	University of Missouri	-	1940

Municipal and rural water supplies, water works planning, swimming pool sanitation, water conditioning, environmental health, extension activities

100% (teaching)

"Development of Water Supply and Treatment," Rider Packing Company

"Appraisal of a Proposed Water Treatment Process," Freese and Associates

Registered professional engineer: Indiana

Consultant and Member of Board of Directors, West Lafayette Water Company

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JOHN D. WOLSZON
Associate Professor
Environmental Engineering

BS	University of Illinois	Chemistry	1951
PhD	Pennsylvania State University	Analytical Chemistry	1955

Chemical aspects of water and wastewater treatment, analysis of environmental samples, process controls

100% (50% teaching, 40% research, 10% administration)

"Field Evaluation of Aerated Lagoon Pretreatment of Corn Processing Wastes," Anheuser-Busch, Inc., 9/71-12/72, co-investigator

Previous full-time professional experience: 8 yrs. (academic)

Member, Water Pollution Control Federation; Member, Standard Methods Committee

RONALD F. WUKASCH
Associate Professor
Environmental Engineering
1973

BSCE	Valparaiso University	-	1961
MSCE	Purdue University	-	1965
PhD	Purdue University	-	1966

Chemical-physical operations in waste treatment, industrial wastes, municipal wastes planning

100% (50% teaching, 40% research, 10% administration)

"Trickling Filter Stone Gradation and Placement," Journal Sanitary Engineering Division, American Society of Civil Engineers, April 1966 (with D. E. Bloodgood)

"Phosphorus Removal with Iron and Polyelectrolytes," Public Works, November 1969 (with E. L. Johnson and J. H. Beeghly)

"Chemical Precipitation and Flocculation," US Patent 3, 488, 717, January 6, 1970 (witn R. D. Goodenough)

"Processo, De Combate A Eutroficacao," Congresso Brasileiro de Engenharia Sanitaria, Sao Paula, January 1971

Registered professional engineer: Michigan

Previous full-time professional experience: 7 yrs. (industrial research and development)

Member, American Institute of Chemical Engineers
Member, Water Pollution Control Federation
Member, American Society of Civil Engineers

Students

		68-69 FT PT	69-70 FT PT	70-71 FT PT	71-72 FT PT	72-73 FT PT	
Environmental Engineering	Master's	-	14	26	32	25	ENROLLMENT
	Doctoral	-	18	12	10	9	
Environmental Engineering	Master's	-	4	7	14	22	GRADUATES
	Doctoral	-	2	3	3	4	
Environmental Engineering	Master's	2					NON-US NATIONALS
	Doctoral	0					

	Master's & Doctoral	
EPA traineeship	20	SUPPORT
EPA doctoral fellowship	1	
Teaching assistantship	4	
Other university support	5	
Self-supported	4	

	Master's	Doctoral	
Industry	28	30	EMPLOYMENT (%)
Government	24	30	
Military	12	10	
Further studies	13	0	
Consulting	15	0	
Research & Teaching	8	30	

Facilities

Offices and laboratories of the environmental engineering unit are housed in a modern air conditioned building completed in 1964. Approximately 14,500 square feet are allotted for our exclusive use. All graduate students are assigned to 2-3 man private office-study rooms adjacent to their research lab. A 1,500 square-foot pilot plant room has direct pumping access to a campus sewer main and the only tap on a ground water well beneath the building.

Purdue Research Park, adjacent to the campus, contains industrial research units engaged in electronics, remote sensing, and environmental research. Cooperative programs exist.

Purdue maintains an active conference program. Students may attend, without charge, any of the annual short schools or conferences dealing with waterworks operation, air pollution, well drilling, swimming pools, corrosion, or the Purdue Industrial Waste Conference.

Rensselaer Polytechnic Institute

Troy, New York

Bio-Environmental Engineering Division
School of Engineering

Environmental Engineering

ECPD Accredited--Environmental Engineering

Dr. William W. Shuster, Chairman
Bio-Environmental Engineering Division
Rensselaer Polytechnic Institute
Troy, NY 12181
(518) 270-6363

Dr. Ray W. Shade, Chairman
Environmental Engineering Curriculum
Rensselaer Polytechnic Institute
Troy, NY 12181
(518) 270-6369

February 1974

The objective of the environmental engineering program at Rensselaer is to provide the opportunity for qualified students to prepare for careers in one of the areas of professional practice or to pursue a career in research and/or teaching. Rensselaer offers programs of study leading to the MEngr, MS, DEngr, and PhD degrees in environmental engineering. Plans of study may be arranged with particular emphasis in areas of water resources, radiological health, solid wastes, or air resources. A wide range of courses are available in the Bio-Environmental Engineering Division as well as other divisions and departments.

Founded in 1824 and the first American college to award degrees in engineering and science, Rensselaer Polytechnic Institute is a coeducational technological university. It is situated on a scenic 260-acre campus on a hill overlooking the Hudson River. It has five schools: Architecture, Engineering, Humanities and Social Sciences, Management, and Science. The Institute is situated in Troy about 150 miles north of New York City and 180 miles west of Boston. Scenic areas, including Lake George and portions of the Adirondack Forest Preserve, are within easy driving distance and offer many attractions for those interested in skiing, boating, hunting, or fishing. The Saratoga Performing Arts Center is the summer home of the Philadelphia Orchestra and the New York City Ballet. The Boston Symphony Orchestra may be heard at nearby Tanglewood, Massachusetts, and dramatic productions are presented by a number of summer theaters. The Rensselaer Field House is the scene of varsity hockey games and many cultural programs.

Admission Requirements

(a) 2.5/4 for Master's degree; 3.4/4 on Master's work.

(b) GRE is desirable but is not required.

(c) No provisional admission is possible at present.

(d) Foreign students must submit score on TOEFL.

(e) Acceptable undergraduate programs include engineering and natural sciences.

(f) Programs for nonengineers may require some basic engineering courses.

(g) Three suitable letters of reference must be submitted.

(h) The Master's degree and a minimum GPA of 3.0/4 for the Master's work are required for doctoral programs.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	21-24S[a]	Yes	No	0	18
MEngr--Envir. Engr.	21-24S[a]	Optional[b]	No	0	12
PhD--Envir. Engr.	30S[c]	Yes	No	12 mo.	48
DEngr--Envir. Engr.	30S[c]	Yes	No	12 mo.	48

[a] Plus 6-9S for thesis.

[b] Project may be substituted for thesis.

[c] Credits beyond completion of Master's degree (plus 30S thesis).

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
31.405	Unit Operations in Envir. Engr.	Shade	3S	F'72	42
31.406	Unit Processes in Envir. Engr.	Shade	3S	S'73	51
31.407	Environmental Acoustics	White	3S	F'72	3
31.409	Water & Wastewater Engineerig	El-Baroudi	3S	F'72	69
31.412	Envir. Engr. Laboratory & Design	El-Baroudi	4S	S'73	40
31.423	Atmospheric Pollution I	Altwicker	3S	F'72	38
31.431	Solid Waste Engineering	El-Baroudi	3S	F'72	25
31.442	Industrial Waste Treatment & Disposal	Shuster	3S	S'73	27
31.601	Public Health I	Shade	2S	F'72	20
31.602	Public Health II	Shade	2S	S'73	14
31.603	Chemistry for Envir. Engr.	Altwicker	3S	F'73	11
31.605	Management & Planning for Poll. Abate.	Hetling	3S	F'72	43
31.607	Mathematical Modeling of Envir. Sys.	Stern	3S	S'73	10
31.611	Water Resources	Aulenbach	3S	F'73	37
31.614	Stream Pollution Control	Aulenbach	3S	S'73	25

31.624	Atmospheric Pollution II	Altwicker	3S	S'73	18
31.632	Solid Waste Laboratory	El-Baroudi	3S	S'73	25
31.662	Envir. Radiation Safety Controls	Aulenbach	4S	S'73	25
31.6971	Special Topics--Adv. Waste Treat. Proc.	Hetling	3S	S'73	18
31.6972	Special Topics--Envir. Law	Coutant	3S	S'73	30
31.6973	Special Topics--Air Pollution Lab.	Altwicker	2S	S'73	8
31.6974	Special Topics--Atmospheric Chemistry	Altwicker	3S	S'73	4
31.715	Limnology	Aulenbach	3S	Su'72	7
31.680	Bio-Envir. Engr. Seminar	Shade	1S	S'73	11
Biol 70.231	Microbiology	Ehrlich	4S	F'72	15
EE 38.661	Envir. Quality Control Systems	Stern	3S	F'72	15
Geol 76.456	Groundwater Hydrology	LaFleur	3S	F'72	12

31.405, 31.406, 31.412, 31.611, and 31.614 are required for water resources majors. 31.405, 31.406, 31.412, 31.423, 31.603 or suitable replacement, 31.6973, and 31.6974 are required for air resources majors. Solid wastes majors must take 31.405, 31.406, 31.412, 31.431, and 31.632. 31.405, 31.406, 31.412, 31.662, 35.471, 70.423, 72.471 and 72.472 must be included in the radiological health program.

Faculty

WILLIAM W. SHUSTER
Professor and Chairman
Bio-Environmental Engineering Division
1945

BChE	Rensselaer Polytechnic Institute	Chemical Engineering	1939
MChE	Rensselaer Polytechnic Institute	Chemical Engineering	1948
DChE	Rensselaer Polytechnic Institute	Chemical Engineering	1952

Industrial waste treatment, unit operations, solid waste engineering

100% (30% teaching, 20% research, 50% administration)

"Control of Pollution from Outboard Engine Exhaust: A Reconnaissance Study," US Environmental Protection Agency Report, Project No. 15020, ENN, 1971

"Partial Oxidation of Solid Organic Wastes," US Public Health Service Publication No. 2133

"Bio-Environmental Engineering at R. P. I.," Rensselaer Engineer, 24, 4, p. 27, April 1971

"Partial Oxidation of Solid Organic Wastes," US Public Health Service, 5/66-4/69, principal investigator

"Control of Pollution from Outboard Engine Exhaust," US Environmental Protection Agency, 1/70-8/70, principal investigator

"Effects of Exhaust from Two-Cycle Outboard Engines," US Environmental Protection Agency, 7/71-10/72, project director

Previous full-time professional experience: 6 yrs. (industry)

Member, AEEP
Member, American Institute of Chemical Engineers; Member, Public Relations Committee; Member, Water Committee; Member, Air Committee; Past Treasurer; Secretary; Vice Chairman; Chairman (1952-date)
Member, American Chemical Society (1970-date)
Member, Water Pollution Control Federation (1965-date)
Member, Air Pollution Control Association (1965-date)
Member, American Public Works Association (1968-date)

RAY W. SHADE
Associate Professor and Chairman
Environmental Engineering Curriculum
1970

BS	Massachusetts Institute of Technology	Chemical Engineering	1949
MS	Massachusetts Institute of Technology	Chemical Engineering	1951
PhD	Rensselaer Polytechnic Institute	Chemical Engineering	1964

Unit operations in environmental engineering, unit processes in environmental engineering, ultrafiltration, ion exchange, high solids microbial systems

100% (40% teaching, 27% research, 33% administration)

"The Application of a High Solids Microbial System to the Treatment of Milk Waste," Proceedings, 28th Annual Purdue Industrial Waste Conference, 1973 (with P. P. Russell)

"Undergraduate Environmental Engineering at Rensselaer Polytechnic Institute," Proceedings, American Association of Professors in Sanitary Engineering (AEEP), August 1972

"Fifteen Years of Environmental Engineering--Status and Assessment," 19th Annual Meeting, Institute of Environmental Sciences, April 1973 (with W. W. Shuster)

Previous full-time professional experience: 19 yrs. (industrial research and development)

Member, AEEP
Member, American Chemical Society (1950-date)
Member, American Institute of Chemical Engineers (1951-date)
Member, New York Academy of Sciences (1961-date)
Member, Federal Water Pollution Control Association (1970-date)

ELMAR R. ALTWICKER
Associate Professor
Bio-Environmental Engineering Division
1968

BS	University of Dayton	Chemistry	1952
PhD	The Ohio State University	Organic Chemistry	1957

Air pollution control, atmospheric chemistry, air pollution laboratory, ozone-olefin reactions, SO_2 scrubbing, NO_x from combustion

100% (70% teaching, 25% research, 5% administration)

"Contribution to the Kinetics of Ozone-Olefin Reactions," Tetrahedron, 1973

"Inhibition of Sulfur Dioxide Oxidation during Alkaline Scrubbings," presented at the Meeting of the American Chemical Society, Division of Air, Water and Waste Chemistry, New York City, August 1972 (with P. Counterman)

"Further Study on the Effects of Additives on Nitric Oxide and Sulfur Dioxide from Oil Combustion," New York State Department of Environmental Conservation, Technical Paper No. 20, May 1972 (with T. T. Shen)

"Chapter III, Section 3.0: Physico-Chemical Nature of Air Pollution," and "Chapter III, Section 3.12: Organic Acids and Phenols" in Environmental Engineer's Handbook (B. G. Liptak, ed.), Crawford and Russell, 1972

"Construction and Performance of a Small Oil Burner and the Effect of Additives on Nitrogen Oxides and Sulfur Oxides Emissions," Proceedings, 4th Annual Meeting, National Fuel Oil Insitute, Philadelphia, October 1971 (with T. T. Shen)

"Pulmonary Surfactant," National Institutes of Health, 9/72-8/75, co-investigator

"Inhibition of Oxidation of Sulfur Dioxide during Scrubbing," National Science Foundation, 9/71-5/73, principal investigator

"Relation of Hydrocarbon to Photochemical Smog," New York State, 6/73-date, principal investigator

Previous full-time professional experience: 11 yrs. (industry)

Member, Eastern New York Section, American Chemical Society; Chairman, Short Course Committee;
Member, Professional Relations Committee (1957-date)
Member, Board of Directors, Middle Atlantic Consortium on Air Pollution (1971-date)
Member, Air Pollution Control Association; Member, Local Section Program Committee (1972-date)
Member, New York Academy of Sciences

DONALD B. AULENBACH
Associate Professor
Bio-Environmental Engineering Division
1960

BS	Franklin and Marshall College	Chemistry	1950
MS	Rutgers University	Sanitation	1952
PhD	Rutgers University	Sanitation	1954

Chemical limnology, water pollution control, water resources, environmental radiation safety

100% (45% teaching, 50% research, 5% administration)

"Sources of Nitrogen and Phosphorus in the Lake George Drainage Basin: A Double Lake," Proceedings, 19th Annual Meeting, Institute of Environmental Sciences, Anaheim, California, April 1973 (with N. L. Clesceri)

"Phosphate Removal from Laundry Waste Water," presented at the Winter Meeting, New York Water Pollution Control Association, January 1972 (with G. E. Galonian); to be published in Journal Water Pollution Control Federation, May 1973

"Nitrogen and Phosphorus Sources and Sinks in Lake George, New York," accepted for publication by American Institute of Chemical Engineers in Water 1972 (with R. V. Hallock)

"Treatment of Milk Truck Washing Wastes by Anaerobic Digestion," Proceedings, 27th Purdue Industrial Waste Conference, May 1972 (with R. V. Hallock)

"Microbial Decomposition and Nutrient Dynamics in Aquatic Ecosystems," invited paper for American Association for the Advancement of Science Meeting, Washington, DC, December 1972

"Treatment of Laundromat Wastes," Water Pollution Control Administration (now US Environmental Protection Agency), 7/1/67-1/31/70, principal investigator

"Macro-Nutrients in Lake George, New York," International Biological Program, 7/1/68-9/30/74, principal investigator

Previous full-time professional experience: 6 yrs. (government)

Member, AEEP
Member, Capital District Section of New York Water Pollution Control Association; Secretary-Treasurer (1965-67 and 1969-73); Member, Water Pollution Control Federation (1953-date)
Member, American Water Works Association (1964-date)
Member, Health Physics Society
Member, American Chemical Society; Member, Division of Water, Air and Waste Chemistry (1948-date)
Member, New York Academy of Sciences (1970-date)

NICHOLAS L. CLESCERI
Associate Professor, Bio-Environmental Engineering Division and
Director, Fresh Water Institute
1965

BCE	Marquette University	Civil Engineering	1958
MSCE	University of Wisconsin	Civil Engineering	1961
PhD	University of Wisconsin	Civil Engineering	1964

Water resources-water quality management, chemistry of phosphorus removal, wastewater organic characterization, algal growth kinetics, multidisciplinary research management

100% (10% teaching, 80% research, 10% administration)

"Sources of Nitrogen and Phosphorus in the Lake George Drainage Basin: A Double Lake," Proceedings, 19th Annual Meeting, Institute of Environmental Sciences, Anaheim, California, April 1973 (with D. B. Aulenbach)

"Phosphorus Removal from Wastewaters: A Cost Analysis," Water and Sewage Works, pp. 82-91, March 1973 (with I. J. Kumar)

"Seasonal Variation in the Plankton and Periphyton Diatoms of Lake George," Journal of Ecology, in press (with S. L. Williams)

"Effect of Wastewater Organic Fractions on the Growth of Selected Algae," presented at the 162nd National American Chemical Society Meeting, Symposium on Bioassay Techniques and Environmental Chemistry, Washington, DC, September 1971, in press (with G. C. McDonald)

"Physical and Chemical Removal of Nutrients" in Algae, Man and the Environment (1967) (D. F. Jackson, ed.), Syracuse University Press, p. 554, 1960

"Diatom Population Changes in Lake George, New York," Office of Water Resources Research, 1/7/63-6/30/73, principal investigator (to be continued)

"Analysis of the Structure and Function of Ecosystems in the Deciduous Forest Biome, Lake George Study," International Biological Program, 7/1/70-8/31/73, principal investigator (to be continued)

"Organic Nutrient Factors Effecting Algal Growth," Federal Water Pollution Control Administration, 7/1/68-8/31/72, principal investigator

Previous full-time professional experience: 2 yrs. (research)

Member, AEEP
Member, Water Pollution Control Federation; Member, Nutrient Analysis Subcommittee (1959-date);
Co-Editor, Manual Practice, Tertiary Treatment (1959-date)
Member, Executive Committee, Deciduous Forest Biome, International Biological Program (1967-date)
Member, Newsletter Committee, Association of Environmental Engineering Professors (1967-date)
Chairman, Lake George Study Group, International Biological Program (1967-date)

HASSAN M. EL-BAROUDI
Associate Professor
Bio-Environmental Engineering Division
1970

BSc	University of Alexandria (Egypt)	Sanitary Engineering	1954
MSc	University of California-Berkeley	Sanitary Engineering	1959
PhD	University of California-Berkeley	Sanitary Engineering	1961

Solid wastes--management engineering principles and disposal characterization and recycling; water resources

100% (55% teaching, 35% research, 10% administration)

"Characterization of Settling Tanks by Eddy Diffusion," Journal Sanitary Engineering Division, American Society of Civil Engineers, 95, SA3, June 1969

"Rate of BOD Reduction by Oxidation Ponds," Journal Water Pollution Control Federation, 39, 10, Part 1, October 1967 (co-authored)

"Process Alternatives for Treatment of Concentrated Waste Streams," Proceedings, 25th Purdue Industrial Waste Conference, Part 2, 1970 (co-authored)

"Stabilization Efficiency of Sewage Ponds in Series," Water Research, 3, 9, September 1969 (co-authored)

"Tracer Dispersion of High-Rate Settling Tanks," Journal Environmental Engineering Division, American Society of Civil Engineers, 99, EE3, pp. 347-368, June 1973

"Leaching Decomposition Relationships in Sanitary Landfills," National Science Foundation, 7/72-6/73, principal investigator

Previous full-time professional experience: 9 yrs. (7 yrs. academic and 2 yrs. research and development)

Member, AEEP
Member, American Society of Civil Engineers (1961-date)
Member, Water Pollution Control Federation (1962-date)
Member, American Water Works Association (1962-date)
Member, International Association on Water Pollution Research (1965-date)
Member, National Association of Solid Waste Management (1973-date)

GARY J. STENSLAND
Assistant Professor
Bio-Environmental Engineering Division
1973

BA	University of South Dakota	Physics	1966
MS	Montana State University	Physics	1969
PhD	Pennsylvania State University	Meterology	1973

Air pollution meteorology, atmospheric visibility, aerosol washout, atmospheric sulfur budgets

100% (50% teaching, 50% research)

"High Temperature Viscosity Ratios for Neon," The Physics of Fluids, 14, pp. 746-748, 1971 (with F. A. Guevara)

Member, American Meterology Society (1969-date)
Member, Air Pollution Control Association (1969-date)

LAWRENCE K. WANG
Assistant Professor
Bio-Environmental Engineering Division
1974

BSCE	National Cheng Kung University	Civil Engineering	1962
MSCE	University of Missouri-Rolla	Structural Engineering	1965
MS	University of Rhode Island	Sanitary Engineering	1967
PhD	Rutgers University	Environmental Engineering	1972

Water supply and distribution, wastewater and sludge treatment, sewer system and treatment plant design, computer applications and optimization, unit operations and unit processes

100% (50% teaching, 50% research)

Environmental Engineering Glossary, technical book, Calspan Corporation, Buffalo, New York, 1974 (editor)

"Continuous Pilot Plant Study of Direct Recycling of Filter Backwash Water," Journal American Water Works Association, 65, 5, pp. 355-358, May 1973 (et al.)

"Effect of pH Adjustment Upon Activated Carbon Adsorption of Dissolved Organics from Industrial Effluents," Proceedings, 27th Annual Purdue Industrial Waste Conference, May 1972 (et al.)

"An Improved Method for the Analysis of Linear Alkylate Sulfonate," Proceedings, 28th Annual Purdue Industrial Waste Conference, May 1973 (et al.)

"A Total Waste Recycle System of a Water Purification Plant Using Alum as Primary Coagulant," Proceedings, 29th Annual Purdue Industrial Waste Conference, May 1974

"Investigation of Methods for Determining Optimum Powdered Carbon and Polyelectrolyte Dosages in Military Wastewater Treatment Systems," US Army Mobility Equipment Research and Development Center, Virginia, 2/73-11/73, project engineer

"Design, Cost Estimation and Optimization of Sewage Collection and Treatment Systems for Housing Development in the Glenwood, New York Area," Craneridge North, Inc., 8/73-1/74, project engineer

"Improved Water Purification Technology," Calspan Corporation, 2/73-2/74, principal investigator

Registered professional engineer: New York, Pennsylvania, and Delaware

Previous full-time professional experience: 6 yrs. (industrial research and development)

Member, Sigma Xi
Member, Institute of Environmental Sciences
Member, American Water Works Association
Member, National Society of Professional Engineers
Member, New York State Society of Professional Engineers

LENORE S. CLESCERI
Assistant Professor
Department of Biology
PhD University of Wisconsin Biochemistry 1963
Environmental biology, microbial decomposition
20%

M. ANSON COUTANT
Lecturer, Bio-Environmental Engineering Division and
Regional Attorney, NY State Department of Environmental Conservation
JD Albany Law School Law 1968
Environmental law
30%

HENRY L. EHRLICH
Professor
Department of Biology
PhD University of Wisconsin Biology 1951
Geomicrobiology
70%

LEO J. HETLING
Adjunct Associate Professor, Bio-Environmental Engineering Division and
Director, Environmental Research and Development Unit,
NY State Department of Environmental Conservation
PhD Rensselaer Polytechnic Institute Environmental Engineering 1964
Advanced waste treatment
25%

ROBERT G. LAFLEUR
Associate Professor
Department of Geology
PhD Rensselaer Polytechnic Institute Geology 1961
Land use planning and zoning
25%

CHARLES E. LAWRENCE
Assistant Professor
Systems Engineering Division
PhD Cornell University Environmental Systems Engineering 1971
Environmental systems and population systems
30%

RICHARD A. PARK
Associate Professor
Department of Geology
PhD University of Wisconsin Geology 1966
Ecology and ecosystems simulation
50%

HELMAN I. STERN
Assistant Professor
Systems Engineering Division

PhD	University of California-Berkeley	Operations Research	1969

The application of operations research and systems analysis to urban and environmental systems, specifically in solid wastes, recreation, housing, and population
50%

FREDERICK A. WHITE
Professor
Nuclear Engineering Division

PhD	University of Wisconsin	History Science/Physics	1959

Environmental acoustics, trace analysis with mass spectrometry
20%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental	Master's	18	5	15	3	26	2	30	15	30	6	ENROLLMENT
Engineering	Doctoral	9	3	17	6	13	4	7	7	8	5	

		69-70	70-71	71-72	72-73	73-74	
Environmental	Master's	4	8	12	11	20	GRADUATES
Engineering	Doctoral	0	2	1	4	5	

Environmental	Master's	1	NON-US NATIONALS
Engineering	Doctoral	1	

	Master's	Doctoral	
EPA traineeship	10	1	SUPPORT
AEC fellowship	1	0	
Research assistantship	2	1	
Teaching assistantship	6	0	
Government employer	2	0	
Government fellowship	1	0	
Private source	1	2	
National Science Foundation	0	1	
Self-supported	7	2	

	Master's	Doctoral	
Industry	30	30	EMPLOYMENT (%)
Consulting	10	10	
Academic	8	24	
Federal government	5	5	
Other government	43	27	
Military	4	4	

Facilities

Instructional and research laboratories, a small library and staff and student offices are located in North Hall on the main Rensselaer campus. Additional laboratory and living facilities are located at the Fresh Water Institute at Lake George. This center is located on Smith Bay on the northeastern shore of Lake George. Instrumentation at the site provides analytical capability in atomic absorption spectrophotometry, infrared spectrophotometry, liquid scintillation counting, gas chromatography, carbon analysis, U-V visible spectrometry, and other specialized apparatus for conducting field and laboratory water quality analyses. There is also available a number of boats for sampling activities and other lake studies.

Rice University

Houston, Texas

Department of Environmental Science and Engineering

Environmental Science
Environmental Engineering

Dr. C. H. Ward, Chairman
Department of Environmental Science and Engineering
Rice University
PO Box 1892
Houston, TX 77001
(713) 528-4141 x785

April 1973

The graduate program in environmental science and engineering at Rice University is concerned largely with water and wastewater engineering, water resource management, and applied water chemistry. However, any student with a desire to pursue a course of research other than in these fields can be fully accomodated via interdisciplinary studies with other departments. Such a student, if admitted as a non-engineer, would be exposed to the engineering aspect of environmental problems, but would be able to concentrate mainly in the area of choice: biology, chemistry, mathematical modeling, etc. The following degrees are offered in the department: MES, MEE, MS and PhD.

Rice University is a privately-endowed institution based upon the goal of providing especially good training for a limited number of students "with a well-developed and strong curriculum in the arts and letters and with emphasis on science and research that is required to meet changing circumstances." The enrollment is around 3,300 with approximately 650 graduate students. Tuition and fees for a full-time graduate student average $2,300 for an academic year.

The University occupies a spacious and well-kept campus of some 300 acres on South Main Street about three miles from the center of the City of Houston. The harmonious proportions of the campus buildings and their intriguing architectural features combine with the natural beauty of the campus to form a setting of rare charm in which the students and faculty may pursue their respective tasks.

Admission Requirements

(a) 3.0/4 for MS and PhD; at department's discretion for Master of Environmental Science or Master of Environmental Engineering.

(b) Combined GRE score at the 70th percentile level or higher for MS and PhD is required. No GRE scores are required for Master of Environmental Science or Master of Environmental Engineering. Advanced GRE test is encouraged.

(c) Provisional or conditional admission is not possible.

(d) No formal language examinations are required for foreign students.

(e) Any baccalaureate or Master's degree in any of the sciences, mathematics, or engineering is acceptable. Consideration is also given to applicants from the humanities.

(f) Nonengineers entering the programs are required to make up courses at the department's discretion.

(g) Applicants must have three letters of recommendation submitted from former professors.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
Master of Envir. Engr.	30S	No	No	None	9
Master of Envir. Science	30S	No	No	None	9
MS--Envir. Sci. & Engr.	30S	Yes	No	24S	18
PhD--Envir. Sci. & Engr.	60S	Yes	No	60S	42

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
Envi 401a	Measurements in Envir. Systems	Kessick	3S	F'72	19
Envi 402b	Lab. Studies in Envir. Processes	Characklis Kessick Staff	3S	S'73	14
Envi 403a	Urban Water Systems	Characklis	3S	F'72	37
Envi 404b	Intro. to Atmospheric Science	Few	3S	S'73	18
Envi 443a	Intro. to Atmospheric Science (or physics)	Few Dessler	3S	New'73	-
Envi 444b	Intro. to Atmospheric Science (or physics) cont'd	Few Dessler	3S	New'73	-
Envi 510a	Envir. Physiology & Toxicology	Fisher Hammond Ward	3S	F'72	10
Envi 510b	Envir. Physiology & Toxicology cont'd	Fisher Hammond Ward	3S	S'73	7
Envi 520a	Envir. Engr. Processes	Akers	3S	F'72	14
Envi 536b	Synthesis of Water Quality Systems	Characklis	3S	S'73	13

Envi 545a	Modeling in Design & Resource Mgt.	Leeds	3S	New'73	-
Envi 550b	Applied Water Chemistry	Kessick	3S	New'73	-
Envi 641a	Advanced Topics	Forbes	3S	F'72	12
Envi 641b	Advanced Topics	Kessick	3S	S'73	8
Envi 645a	Problems in Environmental Planning	Characklis	3S	F'70	8
Ceng 490b	Chemical Reaction Kinetics	Hightower	3S	S'73	30
Ceng 501a	Fluid Mechanics & Transport Processes	McIntyre	3S	F'72	11
Biol 411a	Microbiology	Storck	3S	F'72	74

Envi 401a, 402b, 403a, 536b are required of all majors.

Faculty

W. W. AKERS
Professor
Environmental Science and Engineering, Chemical Engineering
1947

BS	Texas Technical College	Chemical Engineering	1943
MS	University of Texas	Chemical Engineering	1944
PhD	University of Michigan	Chemical Engineering	1950

Separation processes, mass transfer, systems analysis and control

30%

"Limitation of Oxygen Transfer in Warburg Apparatus," Proceedings, 22nd Annual Purdue Industrial Waste Conference, 1967 (with J. D. Bryant and A. W. Busch)

"Concurrent Stratified Flow of Immiscible Liquids," American Institute of Chemical Engineers Journal, 12, p. 999, 1966 (with Ron Darby)

"Analysis of a Variable Volume Ultra-Aortic Balloon Pump in a Mock Circulatory System," American Society of Mechanical Engineers, Paper 70/BHF/5, 1970 (et al.)

"Training in Water Supply and Pollution Control," US Environmental Protection Agency, participant

Previous full-time professional experience: 1 yr. (industry)

Member, American Institute of Chemical Engineers; Member, Program Committee (1957-64, 1969-date);
Member, Professional Development Committee (1964-date)
Member, Fellowship Committee, Southwest Center for Urban Research

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A. W. BUSCH
Professor
Environmental Science and Engineering (on leave of absence)
1955

BS	Texas Technical College	Civil Engineering	1950
SM	Massachusetts Institute of Technology	Sanitary Engineering	1952

Biological oxidation processes, organic pollution management

"Use and Abuse of Natural Water Systems," Journal Water Pollution Control Federation, 43, 7, p. 1480, 1971

"Practical Limitations of Stream Standards in Water Quality Measurement," Chemical Engineering Progress, 67, 6, p. 28, 1971

"Aerobic Treatment of Waste Waters--Principles and Practice," Oligodynamics Press, Houston, 1971

Registered professional engineer: Texas

Previous full-time professional experience: 3 yrs. (industry)

Administrator, Region VI, US Environmental Protection Agency (1972-date)
National Director, Environmental Division, American Institute of Chemical Engineers (1970-71)

W. G. CHARACKLIS
Assistant Professor
Environmental Science and Engineering
1970

BS	The Johns Hopkins University	Chemical Engineering	1964
MS	University of Toledo	Chemical Engineering	1967
PhD	The Johns Hopkins University	Environmental Engineering	1970

Characterization of biological flocs and slimes, biological reactor design and operation

100% (50% teaching, 40% research, 10% administration)

"Review: Attached Microbial Growths I. Attachment and Growth, II. Frictional Resistance Due to Microbial Slimes," Water Research, in press

"Oxygen Supply Limitations in Full-Scale Biological Treatment Systems," Proceedings, 26th Annual Purdue Industrial Waste Conference, 1972 (with J. V. Matson and A. W. Busch)

"Water Pollution Control," Chemical Engineering, Environmental Deskbook, 79, 1972 (with A. W. Busch)

"Effect of Attached Microbial Growths on Recycle Water Systems," National Aeronautics and Space Administration, 9/70-8/72, principal investigator

"Training in Water Supply and Pollution Control," US Environmental Protection Agency, participant

Registered professional engineer: Texas

Previous full-time professional experience: 3 yrs. (1 yr. industry and 2 yrs. academic)

Project Reviewer, US Environmental Protection Agency
Member, Water Pollution Control Federation; Member, Standard Methods Committee
Member, Local Section, American Chemical Society; Member, Committee on Chemistry and Public Affairs

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M. A. KESSICK
Assistant Professor
Environmental Science and Engineering
1972

BSc	London University	Chemistry	1961
PhD	London University	Physical Chemistry	1964

Natural water chemistry, physical-chemical treatment processes

100% (50% teaching, 40% research, 10% administration)

"Phenolic Resins Capable of Boron Complexation," Journal Polymer Science B, 10, p. 527, 1972

"Spectrophotometric Determination of Oxidized Manganese with Leuco Crystal Violet," Environmental Science and Technology, 6, p. 642, 1972 (with Jasenka Vuceta and J. J. Morgan)

"Snake-Cage Redox Polyelectrolytes Based on Anion Exchange Resins," Journal Polymer Science A-1, 9, p. 2957, 1971

"Training in Water Supply and Pollution Control," US Environmental Protection Agency, participant

Previous full-time professional experience: 4 yrs. (3 yrs. industry and 1 yr. consulting)

J. V. LEEDS
Professor
Environmental Science and Engineering, Electrical Engineering
1963

BA & BS	Rice University	Electrical Engineering	1956
MS	University of Pittsburgh	Electrical Engineering	1959
PhD	University of Pittsburgh	Electrical Engineering	1963
JD	University of Houston	Law	1972

Environmental law, resources management, mathematical modeling of natural systems

50%

"Modeling Certain Biological Systems with a Signal Processing Viewpoint," Environmental Science and Technology, 5, pp. 522-531, 1971 (with R. A. Naden)

"Modification of Plume Models to Account for Long Averaging Times," Atmospheric Science, in press (with R. A. Naden)

"Use of Reciprocity Theorem and Mapping Theorems in Locating Anomalous Air Pollution Sources," Institute of Electrical and Electronics Engineers Transactions on Systems, Man and Cybernetics, in press (with R. A. Naden and P. E. Pfeiffer)

"Training in Water Supply and Pollution Control," US Environmental Protection Agency, participant

"Environmental Health and Systems Engineering," US Public Health Service, program director

Registered professional engineer: Texas

Previous full-time professional experience: 7 yrs. (industry)

Member, State Bar of Texas, Environmental Law Section
Member, American Bar Association, National Resources, Administrative Law
Member, Institute of Electrical and Electronics Engineers
Member, Atomic Energy Commission-Atomic Safety and Licensing Panel

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C. H. WARD
Professor and Head, Environmental Science and Engineering
Professor, Biology
1966

BS	New Mexico State University	Biology	1955
MS	Cornell University	Plant Pathology	1957
PhD	Cornell University	Plant Pathology-Physiology	1960

Applied photosynthesis, microbial ecology, stress physiology, biology of water pollution, biological basis for water quality standards

80% (20% teaching, 30% research, 30% administration)

"Carbon Analysis in Pollution Assessment--Concepts vs. Applications," International Symposium on Identification and Measurement of Environmental Pollutants, Ottawa, Canada, pp. 342-346, 1971 (with A. W. Busch)

"Kinetic and Stoichiometric Limitations of Phosphate in Pure and Mixed Microbial Cultures," Developments in Industrial Microbiology, 11, pp. 256-275, 1970 (with D. J. Schaezler and A. W. Busch)

"Cyanide Inhibition of Mixed Microbial Populations," Developments in Industrial Microbiology, 10, pp. 253-270, 1970 (with G. D. Zintgraff and A. W. Busch)

"Training in Water Supply and Pollution Control," US Environmental Protection Agency, 1970-date, program director

"Photosynthetic and Respiratory Activity in Germfree Higher Plant Species," National Aeronautics and Space Administration, project director

Previous full-time professional experience: 5 yrs. (military research)

Member, American Institute of Biological Sciences, Environmental Advisory Panel (1966-72); Chairman, (1969-72)

Member, Model Cities Technical Task Force, Model Cities Program, Houston (1972-date)
Member, Board of Directors, Gulf Universities Consortium on Air Pollution (1972-date)

A. A. FEW
Assistant Professor
Space Science

PhD	Rice University	Space Science and Physics	1969

Meterology and atmospheric phenomena, instrumentation for measuring air pollution
30%

F. M. FISHER
Associate Professor
Biology

PhD	Purdue University	Invertebrate Physiology	1961

Biology and ecology of estuaries and marshlands, effects of pesticides on ecosystems
10%

B. R. HAMMOND
Assistant Professor
Biology

PhD	Cornell University	Physiology	1969

Fish physiology, effects of heavy metals on aquatic systems
10%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master of Envir. Engr.		-	-	-	-	-	-	-	-	-	-	ENROLLMENT
Master of Envir. Science		-	-	-	-	-	-	-	-	4	-	
Environmental Science & Engr.	Master's	4	0	5	0	-	0	12	-	9	-	
	Doctoral	5	0	4	0	7	0	2	-	3	-	
Environmental Science & Engr.	Master's	2		0		2		2		5		GRADUATES
	Doctoral	1		4		3		2		1		
Environmental Science & Engr.	Master's	1		NON-US NATIONALS								
	Doctoral	1										

	Envir. Science & Engr.		
	Master's	Doctoral	
EPA traineeship	7	2	SUPPORT
Other traineeship	1	1	
Foundation support	1	-	
Consulting	20	30	EMPLOYMENT (%)
Industry	50	40	
Federal government	10	-	
Academic	-	15	
Further study	20	-	
Outside environmental area	-	15	

Facilities

Although not used extensively the other universities in the Houston area add considerable breadth to the program. Graduate students at Rice can take courses without formal enrollment or added fee at all of the following institutions: University of Texas School of Public Health, School of Biomedical Science, and School of Medicine; Baylor College of Medicine; and the University of Houston. Courses taken in these institutions are limited to those not offered at Rice but needed to support specific degree and/or research programs.

Rutgers University

The State University of New Jersey
New Brunswick, New Jersey

Civil and Environmental Engineering Department
College of Engineering

Environmental Engineering

ECPD Accredited--Civil Engineering

Dr. Joel Wiesenfeld, Chairman
Department of Civil and Environmental Engineering
Busch Campus
Rutgers University
New Brunswick, NJ 08903
(201) 932-2232

March 1974

The program in environmental engineering includes teaching and research in water resource planning and water quality control. The graduate student is encouraged to select courses in other departments of the University to allow him to concentrate in process control, receiving water quality, river basin planning, systems analysis, systems design, and hydrodynamics. Both the MS and the PhD degrees are offered.

The cooperating activities available to the students in these programs are the courses in the Departments of Environmental Sciences and also Chemical and Biochemical Engineering at Rutgers University. The student may also take courses at Princeton University with no extra charge for tuition and fees. The Water Resources Research Institute of New Jersey is located at Rutgers, New Brunswick.

The University is a land-grant institution with about 16,000 undergraduate students and 5,000 graduate students in New Brunswick. The enrollment in the College of Engineering is 874 undergraduate and 400 graduate students; the corresponding numbers in the Department are 130 (sophomores through seniors) and 50. The graduate enrollment in the environmental engineering program is 23, of these 11 are candidates for the PhD. The tuition and fees for a full-time student averages $916 per academic year.

New Brunswick is located about 33 miles from New York City and 60 miles from Philadelphia and is well served by public transportation.

Admission Requirements

(a) 2.5/4 for MS and a minimum 3.0/4 overall for PhD.

(d) Foreign students must score a minimum of 550 on the TOEFL to be admitted.

(e) Any engineering discipline at an accredited institution is acceptable. Individuals with undergraduate degrees in a scientifically-oriented program are also considered.

(f) Nonengineers must take for no credit a course program in undergraduate science and mathematics equivalent to that required for the BS degree in engineering--in ordinary differential equations and introductory fluid mechanics.

(g) Applicants must have three letters of recommendations submitted from former professors.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	30S	Optional	No	-	12
PhD--Envir. Engr.	72S	Yes	1	2S	36

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CivEng:443	Advanced Hydraulics	Bourodimos	3S	F'73	7
CivEng:501	Analytical Methods in Civil Engr. I	Butler	3S	F'73	19
CivEng:502	Analytical Methods in Civil Engr. II	Butler	3S	S'74	13
EnvEng:561	Advanced Water Supply & Sewage	Granstrom	4S	F'73	9
EnvEng:562	Design of Water & WW Treatment Plants	Granstrom	4S	S'74	12
EnvEng:563	Advanced Hydrology	Yu	3S	F'73	8
EnvEng:564	Unit Processes in Envir. Engr.	Granstrom	3S	S'74	10
EnvEng:566	River Basin Plan. by System Analysis	Yu	3S	S'70	3
EnvEng:567	Analysis of Receiving Water Quality	Yu	3S	S'74	6
EnvEng:586	Advanced Fluid Mechanics	Bourodimos	3S	S'73	8
EnvEng:590	Coastal Engineering	Bourodimos	3S	S'74	11
ChemEng	Special Applications in Chemical Engineering Reactor Analysis	Ahlert	-	S'73	14

Faculty

MARVIN L. GRANSTROM
Professor of Civil and Environmental Engineering
1958

BS	Iowa State University	Civil Engineering	1943
MS	Harvard University	Sanitary Engineering	1947
PhD	Harvard University	Sanitary Engineering	1955

Water supply, sewerage, treatment plant design, hydrology, hydraulics

100% (60% teaching, 40% research)

"Regional Water Quality Management Alternatives: A Case Study," Proceedings, 8th American Water Resources Conference, Series 16, St. Louis, pp. 74-75, 1972 (with S. L. Yu and S. H. Shieh)

"A Chance Constrained Approach to Conjunctive Use of Surface Waters and Ground Waters," Water Resources Research, 7, 6, pp. 1425-1435, 1971 (with G. H. Nieswand)

"A Present Value--Unit Cost Methodology for Evaluating Municipal Wastewater Reclamation and Reuse," Proceedings, American Water Resources Conference, Series 16, p. 108, 1972 (et al.)

"Water Resources Development of the Mullica River Basin: Part II, Conjunctive Use of Surface and Ground Waters of the Mullica River Basin," Water Resources Research Institute, Rutgers University, pp. 1-97, 1973 (with G. H. Nieswand and R. Ahmed)

"Continuous Bubble Fractionation: Part III, Experimental Evaluation of Flow Parameters," Environmental Letters, 5, 2, 1973

"Conjunctive Development of Surface and Ground Waters of the Mullica River Basin," Water Resources Research Institute, 7/68-7/72, co-principal investigator

"Industrial Water and Waste Disposal Requirements," Water Resources Research Institute, 7/66-7/70, co-principal investigator

Registered professional engineer: New Jersey and Ohio

Previous full-time professional experience: 15 yrs. (10 yrs. academic, 2 yrs. consulting and 3 yrs. military)

Member, American Society of Civil Engineers; Member, ECPD Evaluating Team (1969-74)
Member, American Water Works Association
Member, American Chemical Society
Member, American Water Resources Association
Member, Water Pollution Control Federation

EFSTATHIOS L. BOURODIMOS
Professor of Civil and Environmental Engineering
1966

CE	National Technical University of Athens	Civil Engineering	1953
MS	Athenian Technical Institute	Urban Planning	1960
MS	Massachusetts Institute of Technology	Hydraulic Engineering	1963
PhD	Massachusetts Institute of Technology	Hydrodynamics-Water Resources	1966

Hydraulics, hydrodynamics, water resources and environmental engineering, ocean engineering, hydraulic modelling

100% (60% teaching, 40% research)

"Turbulent Transfer and Mixing of Submerged Heated Water Jet," Journal Water Resources Research, 8, 4, pp. 982-997, August 1972

"Cross Spectral Analysis of Rainfall and Runoff for Raritan and Mullica River Basins in New Jersey," International Journal of Hydrology, 21, 1, pp. 61-79, June 1973 (with A. M. Oguntuase)

"Seepage Flows-Field Data Measurements for Evaluation of Potential Contribution of Fertilizers to Groundwater Pollution," Journal Soil Science, 115, 6, June 1973 (with L. Michna)

"Gravity Wave Shoaling and Transformation in Shallow Water," International Journal of Ocean Engineering, 1, 1, pp. 37-76, July 1968

"Correlation Analysis of Water Quality of the Passaic River in New Jersey," Proceedings, Institute of Environmental Sciences, 18th Annual Meeting, pp. 27-35, May 1972 (with R. A. Hahn and A. M. Oguntuase)

Registered professional engineer: Athens, Greece

Previous full-time professional experience: 8 yrs. (industry)

Member, American Society of Civil Engineers
Member, American Geophysical Union
Member, American Water Works Association
Member, Sigma Xi
Member, American Water Resources Association

SHAW L. YU
Associate Professor
Civil and Environmental Engineering Department
1968

BS	National Taiwan University	Civil Engineering	1961
MS	Cornell University	Civil Engineering	1965
PhD	Cornell University	Civil Engineering	1968

Hydrology, applied probability and statistics, water resources sytems, stream and estuarine analysis

100%

"Uncertainties in Water Quality Modelling: The Case of Atmospheric Reaeration," Proceedings, International Symposium on Uncertainties in Hydrologic and Water Resources Systems, 1972

"Aeration Systems for Large Navigable Rivers," Journal Sanitary Engineering Division, American Society of Civil Engineers, 97, SA6, pp. 883-902, December 1971 (with W. Whipple)

"New Developments in Aeration Systems for Large Rivers," Journal American Water Resources Association, 8, 1, pp. 3-14, February 1972 (with W. Whipple and G. Mattingly)

"Assessing Organic Pollution from Agricultural, Urban, and Wooded Lands," Transactions, American Geophysical Union, 52, 12, December 1971 (with W. Whipple and J. Hunter)

"Unrecorded Pollution Sources and Optimum Water Quality Systems," Proceedings, National Symposium on Cost of Water Pollution, North Carolina State University, Raleigh, April 1972 (with W. Whipple and J. Hunter)

"Origins of Pollution in the Delaware Estuary," National Science Foundation, 4/72-11/73, co-principal investigator

"Atmospheric Reaeration in an Estuary," Office of Water Resources Research, 7/72-date, co-principal investigator

"Dynamics of Biochemical Oxygen Demand," Office of Water Resources Research, 7/69-11/72, co-principal investigator

Member, American Society of Civil Engineers
Member, American Geophysical Union
Member, American Water Resources Association

DONALD J. BUTLER
Professor and Director of Graduate Programs
Civil and Environmental Engineering Department
1966

BS	Columbia University	Civil Engineering	1949
MS	Columbia University	Civil Engineering	1953
PhD	Columbia University	Civil Engineering	1958

Engineering mathematics

30% (teaching and administration)

Registered professional engineer: New York

ROBERT C. AHLERT
Professor, Chemical and Biochemical Engineering Department and
Executive Director, Bureau of Engineering Research
1964

BChE	Polytechnic Institute of Brooklyn	Chemical Engineering	1952
MSEng	University of California-Los Angeles	Chemical Engineering	1958
PhD	Lehigh University	Chemical Engineering	1964

Special applications of chemical engineering reactor analysis

"Stochastic Variation of Water Quality of the Passaic River," to be published in Water Resources Research (with Mehta and Yu)

"Analysis of the Dispersion of Thermal Effluents," Chemical Engineering Progress, Symposium Series No. 119, 67, pp. 126-133, 1971 (with Mehta)

"Oxygen Dynamics in the Thermal Mixing Zone," Proceedings, 5th International Water Pollution Research Conference, Pergamon Press, July-August 1970 (with Nochumson)

"Some Finite Difference Solutions for Dispersion of Thermal Sources in Steady Prismatic Flow," Water Resources Research, 6, 2, pp. 614-621, April 1970 (with Biguria and Tarbell)

Registered professional engineer: New Jersey

Member, American Institute of Chemical Engineers; Chairman, Session on Reactor Analysis Applied to the Environment, 70th National Meeting; Chairman, Session on Water Quality and Water Resources Management in the Delaware Basin, 66th Annual Meeting
Consultant, US Environmental Protection Agency (1974)
Member, American Society for Engineering Education
Member, American Society for Testing and Materials; Member, Committee E-27
Fellow, American Insitute of Chemists

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	4	4	4	3	6	5	8	6	3	9	ENROLLMENT
	Doctoral	5	3	5	6	7	4	4	4	5	6	

		69-70	70-71	71-72	72-73	73-74	
Environmental Engineering	Master's	1	4	3	7	-	GRADUATES
	Doctoral	2	1	2	2	-	

Environmental Engineering	Master's	7	NON-US NATIONALS
	Doctoral	7	

	Master's	Doctoral	
University fellowship	-	1	SUPPORT
Research assistantship	1	1	
Teaching assistantship	-	2	
Foundation support	1	-	
Employed	6	6	
Self-supported	4	1	

EMPLOYMENT (%)

	Master's	Doctoral
Consulting	35	25.0
R & D	0	12.5
Industry	0	12.5
Other government	30	12.5
Academic	0	25.0
Further study	30	0
Military	5	12.5

Facilities

The laboratories of sanitary engineering are located in one section of the chemical engineering wing of the College of Engineering Building. The total area is 2800 square feet net plus hydraulics laboratory. The area is divided into rooms for biology including prep room and walk-in incubator, constant temperature, chemistry and analysis, instrumentation, and unit processes. The instrumentation is good and extensive pilot plant equipment is being accumulated. Equipment for field sampling and analysis is available including boat and motor.

An IBM 1130 and an IBM 360-60 unit are available in the immediate vicinity. The water resources research EAI analog computer is also in the immediate vicinity. The library facilities are extensive.

Stanford University

Stanford, California

Civil Engineering Department
College of Engineering

Environmental Engineering

ECPD Accredited--Civil Engineering

Dr. Perry L. McCarty
Director of Environmental Engineering Program
Department of Civil Engineering
Stanford University
Stanford, CA 94305
(415) 321-2300 x3504

February 1974

The environmental engineering curriculum is within the broad water studies program in the Civil Engineering Department at Stanford. This overall program has recently been formalized and expanded in order to better prepare graduate students for tomorrow's needs in all phases of water resources development, from the technical aspects of maintaining a sufficient supply of high quality water through planning and environmental impact assessment. Engineering, social, political, and economic principles of resource management and pollution control are stressed. The faculty and course offerings feature special strengths in environmental engineering, environmental planning, water resources planning, hydromechanics and hydrology. Course offerings are scheduled to permit either intensive study in a single area of interrelated study between areas. Environmental engineering as such has major emphasis in water quality and water pollution control and allows selection of courses to emphasize technical aspects while permitting breadth in water resources engineering and environmental planning. Degrees offered are MS, Civil Engineer, and the PhD.

Stanford is a private university with an enrollment of about 11,000, half of whom are graduate students. The American Council on Education in their 1969 survey of graduate education ranked Stanford among the top three graduate engineering schools in the Nation. There are about 200 graduate students in the Civil Engineering Department, about one-third are in the water studies program, and about one-half of these are in environmental engineering. Tuition and fees for a full-time graduate student average $3,400 for an academic year. The room and board rate is about $1,400 per year.

Stanford is set back against the foothills of the California coast range. The actual campus is situated on a flat plain between the mountains and San Francisco Bay, but Stanford's own land stretches for miles back into the rolling hills. This location combines two important qualities--nature and civilization. One can become lost in the wild and picturesque country stretching west to the ocean, or visit the fast-moving City of San Francisco. These two attractions combine with the multitude of happenings at Stanford to keep students as busy as they want to be.

Admission Requirements

(a) Generally, 2.8/4 for MS; 3.0/4 for Engineers; and greater than 3.2/4 overall for PhD.

(b) GRE scores are considered in the evaluations, but no set cut-off point has been established.

(c) Provisional admission is possible by recommendation of the Admissions Commitee.

(d) Foreign students must submit score on the TOEFL as part of their credentials. Those with low scores may be required or advised to take intensive course work before they enroll for their academic program.

(e) BS degree in engineering or science is normally acceptable.

(f) Nonengineering students need mathematics through calculus and a year of graduate chemistry and physics. Generally, there are no additional undergraduate requirements unless dictated by career goals and graduate program requirements.

(g) Applicants must have three letters of recommendation submitted. Those seeking financial aid should have applications in prior to the March 1 deadline date. Application for admission only, however, is accepted until August 1.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	45Q	No	No	3Q	9
Engineer--Envir. Engr.	90Q[a]	Yes	No	3Q	21[b]
PhD--Envir. Engr.	96Q[c]	Yes	No	9Q	48[d]

[a] 45Q beyond MS.

[b] 12 mo. beyond MS.

[c] 51Q beyond MS.

[d] 3 years beyond MS.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 170	Man & His Environment	Staff	3Q	A'72-73	154
CE 171	Environmental Planning	Ortolano	3Q	W'72-73	60
CE 201	Environmental Fluid Mechanics I	Street	4Q	W'72-73	35
CE 203	Environmental Fluid Mechanics II	Street	4Q	S'72-73	24
CE 229	Seminar on Envir. Impact Assessment	Ortolano	3Q	New'73-74	-
CE 270	Water Quality in Water Res. Develop.	McCarty	3Q	A'72-73	59
CE 271-A	Water Quality Control I	Leckie	3Q	W'72-73	32
CE 271-B	Water Quality Control II	McCarty	3Q	S'72-73	27
CE 272	Environmental Biology	Young	3Q	S'72-73	20
CE 273	Water Chemistry	Leckie	3Q	A'72-73	37
CE 273-A	Water Chemistry Lab.	Leckie	1Q	A'72-73	17
CE 274	Water Microbiology	Young	3Q	W'72-73	38
CE 275-A	Water Quality Control Processes I	Leckie	3Q	W'72-73	18

CE 275-B	Water Quality Control Processes II	McCarty	3Q	S'72-73	15
CE 276-A	Nuclear Methods in Envir. Engr.	P. Kruger	3Q	S'72-73	8
CE 276-B	Envir. Impact of Power Generation	P. Kruger	2Q	New'73-74	-
CE 276-C	Environmental Radioactivity	P. Kruger	3Q	S'72-73	11
CE 279	Environmental Engineering Seminar	Leckie Young	1Q	S'72-73	60
ME 137	Air Pollution	C. Kruger	3Q	A'72-73	72
ME 138	Noise Pollution	Reynolds	3Q	S'72-73	28
ME 180	Energy & Society	Connolly	3-5Q	S'72-73	48
CE 207	Open Channel Hydraulics & Sedimentation Problems	Franzini	4Q	S'72-73	20
CE 220	Philosophy of Planning	Linsley	3Q	New'73-74	-
CE 222	Water Resources Planning	Linsley	3Q	S'72-73	38
CE 223	Economics of Public Works	Roggeveen	3Q	A'72-73	43
CE 224	Institutional Setting of Public Works	Roggeveen	3Q	W'72-73	34
CE 225	Financing of Public Works	Roggeveen	3Q	S'72-73	30
CE 226	Quantitative Planning Techniques	Ortolano	3Q	A'72-73	53
CE 227	Economics & Engineering Planning	Ortolano	3Q	W'72-73	19
CE 233	Statistical Models in Civil Engr.	Shah	4Q	A&W'72-73	63
CE 266	Engineering Hydrology	Linsley	4Q	A'72-73	34
CE 267	Advanced Hydrology	Linsley	4Q	W'72-73	19
CE 268	Water Resources Development	Franzini	4Q	New'73-74	-

Generally, CE 270, 271-A, 271-B, 273, 273-A, and 274 are taken by all environmental engineering majors.

Faculty

PERRY L. MCCARTY
Professor and Director
Environmental Engineering Program
Civil Engineering Department
1962

BS	Wayne State University	Civil Engineering	1953
MS	Massachusetts Institute of Technology	Sanitary Engineering	1957
ScD	Massachusetts Institute of Technology	Sanitary Engineering	1959

Biological processes in environmental engineering, wastewater treatment, nutrient removal, biological processes in natural waters

100% (40% teaching, 40% research, 20% administration)

Chemistry for Sanitary Engineers, 2nd ed., McGraw-Hill Book Company, 1967 (with C. Sawyer)

"Energetics and Bacterial Growth," Chapter 21 in Organic Compounds in Aquatic Environments (S. D. Faust and J. V. Hunter, eds.), Marcel Dekker, Inc., New York, pp. 495-531, 1971

"Unified Basis for Biological Treatment Design and Operation," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, SA3, pp. 757-778, 1970 (with A. W. Lawrence)

"Nitrification with Submerged Filters," Journal Water Pollution Control Federation, 44, pp. 2086-2102, 1972 (with R. T. Haug)

"Trace Elements in Water: Origin, Fate and Control-Mercury," National Science Foundation, 3/72-8/73, co-principal investigator

"The Nature, Ecological Significance, and Removal of Soluble Organic Nitrogen in Treated Agricultural Wastewaters," US Bureau of Reclamation, 7/72-6/73, principal investigator

"Characterization of Soluble Organic Nitrogen and Wastewater Treatment Plant Effluents in Natural Waters," National Aeronautics and Space Administration Ames Research Center, 7/73-6/74, collaborator

Previous full-time professional experience: 6 yrs. (4 yrs. teaching and 2 yrs. consulting)

Member, American Water Works Association; Chairman and Trustee, Water Quality Division (1967-date)
Chairman, Gordon Research Conference, Environmental Sciences--Water (1972)
Consultant, Training Grants Division, US Environmental Protection Agency (1970-date)
Consultant, US Bureau of Reclamation, US Public Health Service, California Department of Water Resources, California Water Resources Control Board

PAUL KRUGER
Professor of Nuclear Civil Engineering
Civil Engineering Department
1962

BS	Massachusetts Institute of Technology	Chemistry	1950
PhD	University of Chicago	Nuclear Chemistry	1954

Environmental impact of power generation, environmental radioactivity, use of nuclear methods in civil engineering and environmental studies

100% (50% teaching, 30% research, 20% administration)

Principles of Activation Analysis, John Wiley and Sons, 1971

Geothermal Energy, Stanford Press, 1973 (ed. with C. Otte)

"Nuclear Civil Engineering," Syllabus, US Atomic Energy Commission-TID-23748, 1966

"Groundwater Transport from Craters and Quarries," US Army Corps of Engineers, NCG-TR 30, 1971

"Vanadium Concentrations in Colorado River Basin Waters," Journal American Water Works Association, 61, pp. 85-88, 1969 (with K. D. Linstedt)

"Stimulation of Geothermal Aquifers," National Science Foundation, 10/72-2/75, co-principal investigator

"Nuclear Explosive Engineering Education," US Atomic Energy Commission, 6/69-6/74, principal investigator

Registered professional engineer: Pennsylvania

Previous full-time professional experience: 8 yrs. (industry)

Member, American Nuclear Society; Chairman, Civil Explosives Applications Division (1967-70)
Consultant to Lawrence Radiation Laboratory, Livermore Plowshare, and Corps of Engineers Program, and to industrial concerns (1966-date)

JAMES O. LECKIE
Assistant Professor
Civil Engineering Department
1970

BS	San Jose State College	Civil Engineering	1964
SM	Harvard University	Environmental Engineering	1965
PhD	Harvard University	Water Chemistry	1970

Water chemistry, physical-chemical unit processes in environmental engineering, exchange processes at the sediment-water interface

100% (50% teaching, 40% research, 10% administration)

"Chemistry of Groundwaters: Models for Their Composition," Environmental Science and Technology, 1, p. 298, 1970 (with W. Stumm)

"Phosphate Precipitation," in Advances in Water Quality Improvement--Physical and Chemical Processes (E. Gloyna and W. Eckenfelder, eds.), University of Texas Press, 1970 (with W. Stumm)

"Phosphate Exchange with Sediments: Its Role in the Productivity of Surface Waters," Proceedings, 5th International Conference on Water Pollution Research, III, p. 26, 1970 (with W. Stumm)

Water Chemistry Laboratory Manual, American Association of Professors in Sanitary Engineering, 1972 (et al.)

"Trace Elements in Water: Origin, Fate and Control-Mercury," National Science Foundation, 3/72-8/73, co-principal investigator

"Polychlorinated Biphenyls (PCB's) in Sediments," Polhemus Fund, Stanford, 4/73-12/73, principal investigator

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LILY Y. YOUNG
Assistant Professor
Civil Engineering Department
1972

BS	Cornell University	Biological Sciences	1965
MS	Cornell University	Microbiology	1967
PhD	Harvard University	Environmental Sciences	1972

Marine and freshwater microbiology, microbial ecology of natural populations

"The Primary Microbial Film and Marine Fouling," Technical Report No. 3 ONR, Division Engineering and Applied Physics, Harvard University, 1972 (with R. Mitchell)

"Chemotaxis and Microbial Fouling," *Bacteriological Procedures*, 164, 1972 (with R. Mitchell)

"The Role of Chemotactic Responses in Primary Microbial Film Formation," *Proceedings*, 3rd International Congress on Marine Corrosion and Fouling, in press (with R. Mitchell)

"Negative Chemotaxis of Marine Bacteria to Toxic Chemicals," *Applied Microbiology*, in press (with R. Mitchell)

"Microbial Ecology at Surfaces in the Natural Environment," Stanford Research Development Fund, 12/72-12/73, principal investigator

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ROBERT L. STREET
Professor and Department Head
Civil Engineering Department
1962

MS	Stanford University	Civil Engineering	1957
PhD	Stanford University	Fluid Mechanics/Mathematics	1963

Environmental fluid mechanics, thermal pollution, energy transfer from water, water quality modeling

60% (30% teaching, 30% research)

"Two-Dimensional Dispersion," *Journal Sanitary Engineering Division*, American Society of Civil Engineers, *93*, SA6, pp. 17-39, December 1967 (with J. C. Bruch)

"Computation of Alongshore Energy and Littoral Transport," *Proceedings*, 12th Coastal Engineering Conference, American Society of Civil Engineers, 1970 (with T. R. Mogel and B. Perry)

"Transport Phenomena in a Laboratory Wind-Wave Channel: II. Evaporation and Energy Transfer," 4th Australian Conference on Hydrology and Fluid Mechanics, December 1971 (*et al*.)

"Numerical Modeling of Thermal Loading in Bodies of Water," Office of Water Resources Research, 10/71-9/74, principal investigator

"Continuing Studies of Transport Processes Across an Air-Water Interface," National Science Foundation, 5/73-4/75, principal investigator

"Continuing Studies of Air-Sea Interactions," National Science Foundation, 12/71-12/73, co-principal investigator

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JOSEPH B. FRANZINI
Professor and Associate Department Head
Civil Engineering Department
1946

BS	California Institute of Technology	Civil Engineering	1942
MS	California Institute of Technology	Civil Engineering	1943
PhD	Stanford University	Civil Engineering	1950

Hydraulics, hydrology, water resources engineering, sedimentation problems

40% (30% teaching, 10% research)

Water Resources Engineering, 2nd ed., McGraw-Hill Book Company, 1972 (with Ray K. Linsley)

Fluid Mechanics with Engineering Applications, 6th ed., McGraw-Hill Book Company, 1965 (with Robert L. Daugherty)

"Moisture Movement in a Horizontal Soil Column under the Influence of an Applied Pressure," Journal Geophysical Research, 73, pp. 5151-5157, August 1968 (with William Yeh)

"Urbanization's Drainage Consequences," Journal Urban Planning and Development Division, American Society of Civil Engineers, pp. 217-237, December 1971 (with Paul O. Reimer)

Registered professional engineer: California

LEONARD ORTOLANO
Assistant Professor
Civil Engineering Department
1970

BS	Polytechnic Institute of Brooklyn	Civil Engineering	1963
MS	Harvard University	Engineering	1966
PhD	Harvard University	Engineering	1969

Environmental impact assessment, operations research, mathematical economics in environmental and water resources engineering

100% (60% teaching, 30% research, 10% administration)

"An Examination on Non-Treatment Plant Alternatives in Water Pollution Control," Chemical Engineering Progress Symposium Series No. 90, 64 (with H. A. Thomas, Jr.)

"The Movement and Quality of Coastal Waters: A Review of Models Relevant to Long Island, New York," Technical Report No. 7722-377, Center for the Environment and Man, Inc., Hartford, Connecticut, 1970 (with P. S. Brown, Jr.)

"An Analysis of Environmental Statements for Corps of Engineers Water Projects," preliminary draft being reviewed by US Army Engineers Institute for Water Resources, 1971 (with W. W. Hill, Jr.)

"Artificial Aeration as a Substitute for Waste Water Treatment," Chapter 7 in Models for Managing Regional Water Quality (R. Dorfman et al., eds.), Harvard University Press, Spring 1972

"Evaluation of Environmental Impacts of Water Resources Project," US Department of the Army, Corps of Engineers, 7/71-10/73, principal investigator

"The Effectiveness of National Environmental Policy Act of 1969 in Water Resources Planning," US Department of the Interior, 11/72-4/74, principal investigator

Previous full-time professional experience: 3 yrs. (1 yr. industry and 2 yrs. government)

RAY K. LINSLEY
Professor of Water Resources Planning
Civil Engineering Department
1950

BS	Worcester Polytechnic Institute	Civil Engineering	1937

Water resources planning, hydrology

50% (40% teaching, 10% research)

Water Resources Engineering, 2nd ed., McGraw-Hill Book Company, 1972 (with J. B. Franzini)

Applied Hydrology, McGraw-Hill Book Company, 1949 (with M. A. Kohler and J. L. H. Paulhus)

Elements of Hydraulic Engineering, McGraw-Hill Book Company, 1955 (with J. B. Franzini)

Hydrology for Engineers, McGraw-Hill Book Company, 1958 (with M. A. Kohler and J. L. H. Paulhus)

Registered professional engineer: Connecticut and California

Previous full-time professional experience: 13 yrs. (3 yrs. industry and 10 yrs. government)

Commissioner, US National Water Commission (1969-date)
Member, American Geophysical Union; President and Secretary, Hydrology (1956-59)
Technical Assistant, Office of Science and Technology (1964-65)
Member, American Society of Civil Engineers; Water Resources Coordinator, Hydraulics Division (1965-67)

CHARLES KRUGER
Professor
Mechanical Engineering Department
PhD Massachusetts Institute of Technology Mechanical Engineering 1960
Air pollution effects and control
15%

WILLIAM C. REYNOLDS
Professor and Head of Mechanical Engineering
PhD Stanford University Mechanical Engineering 1958
Noise pollution
15%

THOMAS J. CONNOLLY
Professor
Mechanical Engineering Department
PhD California Institute of Technology Mechanical Engineering 1950
Energy and society
15%

GEORGE A. PARKS
Professor
Applied Earth Sciences
PhD Massachusetts Institute of Technology Metallurgy 1960
Heavy metal pollution control, water chemistry and thermodynamics, surface chemistry
60%

Students

		68-69 FT	68-69 PT	69-70 FT	69-70 PT	70-71 FT	70-71 PT	71-72 FT	71-72 PT	72-73 FT	72-73 PT	
Environmental Engineering	Master's	12	0	19	0	29	1	31	1	36	5	ENROLLMENT
	Engineers	7	0	5	0	6	-	5	-	4	-	
	Doctoral	6	0	7	0	9	-	9	-	9	-	
Environmental Engineering	Master's	8		19		21		33		37		GRADUATES
	Engineers	5		2		2		2		2		
	Doctoral	5		3		1		4		1		
Environmental Engineering	Master's	3		NON-US NATIONALS								
	Engineers	0										
	Doctoral	0										

	Master's	Engineers	Doctoral	
EPA traineeship	18	-	1	SUPPORT
EPA doctoral fellowship	-	-	2	
Research assistantship	1	2	3	
Teaching assistantship	3	2	1	
Other university support	2	-	1	
Government employer	3	-	1	
Industrial employer	1	-	-	
Consultant employer	1	-	-	
Self-supported	8	-	-	
University employer	2	-	-	
Consulting	40	-	8	EMPLOYMENT (%)
Industry	6	20	16	
Federal government	25	40	8	
Other government	8	-	-	
Academic	2	20	67	
Further study	15	20	-	
Unknown	3	-	-	

Facilities

The environmental engineering water quality control research laboratory is housed in the George Havas Building and the teaching laboratories are located in the adjoining building. The research laboratories consist of 8,000 square feet of space and include six temperature controlled rooms and an array of analytical instruments as required for experimental research in water quality control and environmental radioactivity. The teaching laboratories consist of about 3,500 square feet of space for water chemistry, microbiology, and water quality control unit process studies.

Syracuse University

Syracuse, New York

Department of Civil Engineering
College of Engineering

Sanitary Engineering
Sanitary Science

ECPD Accredited--Civil Engineering

Dr. Paul J. Brennan, Chairman
Department of Civil Engineering
Syracuse University
Syracuse, NY 13210

Dr. M. C. Rand
Professor of Sanitary Engineering
Syracuse University
Syracuse, NY 13210

August 1973

The graduate program is a broad curriculum which developes and builds upon foundations in sanitary microbiology, sanitary chemistry, and engineering design. Seminars with student participation are required each semester. Elective courses (20 percent of Master's program) are available in air or stream pollution analysis and abatement and solid wastes. The PhD program requires proficiency in at least two minor areas and a demonstrated knowledge in two tools of research in environmental engineering, generally one language and the use of the computer.

The graduate enrollment is generally between 10 and 25 full- and part-time students. Classes are small with individual instruction and performance stressed. Normally three to five Master's degrees and one or two PhD degrees are awarded each year.

The degrees in sanitary science allow more electives from the supporting environmental sciences and omits the engineering design courses. Candidates for these degrees generally possess undergraduate degrees in one of the basic science areas.

Major areas of graduate study within the department are concerned with water and wastewater analysis and treatment, stream pollution, and industrial waste treatment. Outside the department, but within the College, subject areas of air pollution monitoring and measurements and noise pollution are available. In other colleges, special courses in environmental law, public administration, forestry conservation and management, geology, and finance, as well as additional courses in chemistry and biology, are available to graduate students.

Admission Requirements

(g) All applicants are considered on an individual basis. More emphasis is placed upon references from recognized professional people, eagerness, and intent of the applicant, and specific area of specialization desired than upon grades of an undergraduate. Generally, however, the successful applicant will have graduated from an accredited college in science or engineering with an average of 2.75 or higher.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Sanitary Engr.	30S[a]	Optional	No	-	12-36
MS--Sanitary Science	30S[a]	Optional	No	-	12-36
PhD	60S[b]	Yes	-	-	48-72

[a] In some cases, 12S of coursework may be substituted for 6S of thesis.

[b] Additional hours of which no more than 30S can be dissertation credits.

Course Work

The coursework is arranged by consultation with graduate faculty advisor. Generally, broad foundation backgrounds are required at the Master's level and areas of specialization are called for at the PhD level.

Faculty

M. C. RAND
Professor
Civil Engineering Department

PhD Rutgers University - -

Sanitary chemistry

100% (teaching)

Member, Water Pollution Control Federation; Chairman, Standard Methods Committee

NELSON L. NEMEROW
Professor
Civil Engineering Department

PhD Rutgers University

Industrial waste treatment

100% (teaching)

Facilities

Three well-equipped and maintained separate laboratories are available to all students in the program.

The University of Tennessee-Knoxville

Knoxville, Tennessee

Environmental Engineering Program
Civil Engineering Department
College of Engineering

Environmental Engineering

Dr. William A. Drewry
Environmental Engineering Program
Civil Engineering Department
The University of Tennessee
Knoxville, TN 37916
(615) 974-5187

Dr. William L. Grecco, Head
Civil Engineering Department
The University of Tennessee
Knoxville, TN 37916
(615) 974-2503

May 1973

The orientation of the environmental engineering graduate program at The University of Tennessee-Knoxville is environmental pollution control and water resources management. The student can specialize in the areas of air pollution control, air resources management, water quality control (including water supply and treatment and wastewater collection, treatment, and disposal), solid waste management, and water resources engineering and management. We offer both the MS and PhD degrees.

The University of Tennessee is both the state university and the official land-grant institution of Tennessee. The present Knoxville campus enrollment is around 24,000 with approximately 5,000 graduate students. Located in or near Knoxville are the extensive facilities of the Tennessee Valley Authority and Oak Ridge National Laboratory. Faculty and students of the environmental engineering program frequently are involved with both of these organizations on cooperative research projects of mutual interest. The faculty and students of the environmental engineering program enjoy excellent working relationships with local, municipal, and industrial officials. Also, the College of Engineering is administering a multifaceted research effort for the State of Tennessee Pollution Control Agency. Tuition and fees for full-time graduate students average about $400 (residents) and $1,200 (nonresidents).

The University of Tennessee's Knoxville campus is located in the heart of East Tennessee near many lakes of the Tennessee Valley Authority and is less than 40 miles from the Great Smoky Mountains National Park. The winters in Knoxville are mild, yet a favorite Southern winter sport includes snow skiing at the well-known Gatlinburg resort area located nearby. Other recreational opportunities are almost unlimited with fishing, boating, hunting, skiing, hiking, etc. facilities available. On-campus recreation facilities available are generally unequaled in this country.

Admission Requirements

(a) Minimum 2.5/4 required for MS; individual evaluation for admission to PhD program.

(b) GRE is not required.

(c) Admission to Master's program is possible for less than 2.5/4 GPA with additional courses being required. Student must obtain a minimum grade of B in all courses in the first quarter to obtain full graduate standing.

(d) Foreign students must pass the TOEFL with a minimum score of 500.

(e) Any engineering discipline at an accredited institution is acceptable. Bachelor's degrees in other fields may be accepted but may require prerequisite undergraduate courses.

(f) Variable prerequisite requirements depending upon individual evaluation of applicant's records.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	45Q	Optional[a]	No	3Q	12
PhD--Civil Engr.	108Q	Yes	No	3Q	30

[a] There are two options available in the MS program: I--a minimum of 45Q required, including 9Q of thesis, and II--a minimum of 48Q required.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
ENVR 5230	Surface Water Trans. Proc.	Overton	3Q	A'72	6
ENVR 5232	Sediment Transportation	Tschantz	3Q	Su'71	4
ENVR 5234	Flood Damage Reduction	Tschantz	3Q	S'72	5
ENVR 5301	Advanced Hydr. Analysis I	Overton	3Q	New'73	-
ENVR 5302	Advanced Hydr. Analysis II	Overton	3Q	New'73	-
ENVR 5340	Water Resource Systems	Overton	3Q	New'73	-
ENVR 5310	Groundwater Flow I	Tschantz	3Q	S'72	9
ENVR 5311	Groundwater Flow II	Overton	3Q	W'73	8
ENVR 5501	Water & WW Treatment Theory I	Drewry	3Q	A'72	18
ENVR 5502	Water & WW Treatment Theory II	Drewry	3Q	W'73	15
ENVR 5513	Advanced Water & WW Treatment Systems	Drewry	3Q	S'73	15
ENVR 5543	Industrial Wastes	Drewry	3Q	W'72	7
ENVR 5561	Aquatic Environmental Pollution	Burdick	3Q	W'73	11
ENVR 5571	Envir. Engineering Chemistry	Burdick	3Q	A'72	17
ENVR 5582	Microbiology for Envir. Engr.	Burdick	3Q	W'73	14
ENVR 5593	Advanced Envir. Engr. Lab.	Burdick	3Q	S'73	8
ENVR 5600	Solid Wastes	Boegly	3Q	S'73	27
ENVR 5710	Air Pollution Control Engineering	Noll	3Q	A'72	49
ENVR 5720	Air Pollution Particle Collection Theory	Noll	3Q	S'73	9
ENVR 5730	Air Pollution Control Development and Design	Noll	3Q	S'73	9

ENVR 5740	Dynamical & Physical Met.	-	3Q	A'71	7
ENVR 5750	Turbidity in the Atmosphere	-	-	W'72	7
ENVR 5760	Diff. in the Atmosphere	-	-	S'72	7
ENVR 6820	Advanced Theory & Applications in Water Resources Engr. Systems I	Tschantz	3Q	A'72	3
ENVR 6910	Special Topics in Envir. Engr.	Drewry	3Q	A'72	7
ENVR 6920	Special Topics in Envir. Engr.	Drewry	3Q	W'73	9
ENVR 6930	Special Topics in Envir. Engr.	Drewry	3Q	S'73	6

In order to maintain a maximum degree of flexibility, no specific courses are required of all students. Each student's program is tailored to meet his specific needs and desires.

Faculty

J. CLEMENT BURDICK, III
Environmental Engineering Program
Department of Civil Engineering
1969

BS	Vanderbilt University	Civil Engineering	1964
MS	Vanderbilt University	Sanitary & Water Resources Engr.	1967
PhD	Vanderbilt University	Envir. & Water Resources Engr.	1971

Water quality modeling, water and wastewater treatment process design, air pollution monitoring and modeling, solid waste system design

100% (50% teaching, 50% research)

"Estimation of Water Quality in a New Reservoir," Report No. 8, National Center for Research and Training in the Hydrologic and Hydraulic Aspects of Water Pollution Control, Department of Environmental and Water Resources Engineering, Vanderbilt University, 1971 (with F. L. Parker) (also issued as a report of the US Army Corps of Engineers, Nashville District)

"Impact of Sewage Treatment Modifications on Water Quality of a Reservoir," *Water Resources Bulletin*, American Water Resources Association, accepted for publication, 1973 (with J. D. Womack and F. C. Larson)

Proceedings of the First (Second, Third) Annual Industrial Air Pollution Control Conference, "State of the Art of Air Pollution Control Techniques for Industrial Processes and Power Generation," Department of Civil Engineering, The University of Tennessee, 1971 (1972, 1973) (*et al*., eds.)

"A Solid Waste Disposal Plan for a Twenty-Six County Region in Tennessee," Report of the Engineering Experiment Station, College of Engineering, The University of Tennessee, 1973 (*et al*.)

"Proceedings of a Conference and Workshop on Identification of Water Resources Research Needs," Research Report No. 29, Water Resources Research Center, The University of Tennessee, 1972 (edited)

"Planning Study of the West Fork of Stones River," Murfreesboro Water and Sewer Department (EPA funds), 12/72-4/73, co-principal investigator

"Heavy Metals in the Environment," State of Tennessee, 7/72-7/73, principal investigator

"Measuring and Minimizing the Social Cost of Environmental Pollution: A Case Study of the Economics of Waste Discharge, Waste Abatement, and Waste Control Policies," National Aeronautics and Space Administration, 7/71-12/72, co-principal investigator

Registered professional engineer: Tennessee

Previous full-time professional experience: 1 1/2 yrs. (government)

Consultant, Oak Ridge National Laboratory (1972-date)
Consultant, Aluminum Company of America, Tennessee Operations (1972-73)
Consultant, Tennessee Valley Authority (1971-date)

WILLIAM A. DREWRY
Associate Professor
Environmental Engineering Program
Department of Civil Engineering
1968

BSCE	University of Arkansas	Civil Engineering	1959
MSCE	University of Arkansas	Civil Engineering	1961
PhD	Stanford University	Civil Engineering	1968

Wastewater treatment, water treatment, solid wastes disposal

100% (50% teaching, 25% research, 25% administration)

"Virus Movement in Groundwater," Journal Water Pollution Control Federation, 40, 8, 1968 (with R. Eliassen)

Correspondence Course Manual for Water Plant Operators, Class C, 2nd ed., The South Carolina Water and Pollution Control Association, 1971 (with W. M. McLellon and J. M. Glennon)

"Virus Removal--Water and Wastewater," Report No. 24, Water Resources Research Center, The University of Tennessee, 1972 (NTIS PB-210 957)

"Virus Removal--Water and Wastewater," The University of Tennessee Water Resources Research Center, 6/69-1/72, principal investigator

"Characteristics of Municipal Refuse," Union Carbide Corporation, 9/71-6/72, principal investigator

"Planning Study of West Fork Stones River," Water and Sewer Department, City of Murfreesboro, Tennessee, 12/72-5/73, co-principal investigator

Registered professional engineer: Tennessee and Arkansas

Previous full-time professional experience: 5 yrs. (4 yrs. academic and 1 yr. government)

Member, AEEP
Member, Board of Certification for Water and Wastewater Operators, State of Tennessee (1971-date)
Consultant, Aluminum Company of America, Tennessee Operations (1972-73)
Consultant, Oak Ridge National Laboratory (1972-date)

ROGER A. MINEAR
Associate Professor
Environmental Engineering Program
Department of Civil Engineering
1973

BS	University of Washington	Chemistry	1964
MSE	University of Washington	Sanitary Engineering	1966
PhD	University of Washington	Civil Engineering	1971

Nature, origin, transport, and transformation of organic and inorganic substances in natural and wastewaters; chemistry of aqueous solutions and chemical processes of water and wastewater treatment; trace metal and environmental analyses

100% (67% teaching, 33% research)

"Organics in Lakes," in Organic Compounds in Aquatic Environments, Marcel Dekker, 1971 (with R. F. Christman)

"Wastewater Treatment Technology," Illinois Institute for Environmental Quality, Report No. IIEQ 71-4, State of Illinois, 1971 (with J. W. Patterson)

"Characterization of Naturally Occurring Dissolved Organophosphorus Compounds," Environmental Science and Technology, 6, 5, 1972

"Methods of Trace Metals Analysis in Aquatic Systems," Trace Metals and Metal-Organic Interactions in Natural Waters, Ann Arbor Science Publishers, 1973 (with B. B. Murray)

"The Application of Gas Chromatography of Volatile Metal Chelates to Water Analysis," in Chemistry of Water Supply, Treatment and Distribution, Ann Arbor Science Publishers, 1973 (with C. M. Palesh)

"Investigation of the Chemical Identity of Soluble Organophosphorus Compounds Found in Natural Waters," Water Resources Center, University of Illinois, 7/72-9/73, principal investigator

"Application of Gas Chromatography to Metal Analysis in Natural Waters," Water Resources Center, University of Illinois, 7/73-6/74, principal investigator

Previous full-time professional experience: 4 yrs. (academic)

Member, AEEP
Member, American Chemical Society, Division of Environmental Chemistry (1968-date)
Member, Water Pollution Control Federation (1968-date); Member, Research Committee (1971-date)
Member, American Water Works Association (1970-date); Member, Student Activities Committee (1971-date)
Consultant, State of Illinois Institute for Environmental Quality, Septic Tanks and Wastewater Treatment Technology (1971-72)
Consultant, Argonne National Laboratories, Faculty Workshop Program (1971-date)

BERT C. MULLINS
Assistant Professor
Environmental Engineering Program
Civil Engineering Department
1963

BS	Lincoln Memorial University	Biology	1947
BS	The University of Tennessee	Civil Engineering	1962
MS	The University of Tennessee	Sanitary Engineering	1963
MS	Georgia Institute of Technology	Civil Engineering	1965

Hydraulics, hydrology, wastewater treatment, water and wastewater analysis

50% (teaching)

Registered professional engineer: Tennessee

Member, American Society for Engineering Education (1971-date)
Member, Knoxville Technical Society (1972-date)

KENNETH E. NOLL
Associate Professor
Environmental Engineering Program
Civil Engineering Department
1970

BS	Michigan Technical University	Civil Engineering	1959
MS	University of Washington	Civil Engineering	1965
PhD	University of Washington	Civil Engineering	1969

Air resources engineering, atmosphere aerosol technology, air monitoring, design of control devices

100% (70% teaching, 30% research)

Industrial Air Pollution Control, Ann Arbor Science Publishers, April 1973 (with J. R. Duncan)

"New Criteria for the Selection of Fabric Filters for Industrial Application," 1973 National Meeting, Air Pollution Control Association (with W. T. Davis and S. P. Shelton)

"Visibility and Aerosol Concentration in Urban Air," Atmospheric Environment, 2, 1968 (with Mueller and Imada)

"A Rotary Inertial Impactor for Sampling Giant Particles in the Atmosphere," Atmospheric Environment, 4, 1970

"Visibility and Aerosol Size Frequency Distribution," Journal Applied Meteorology, 6, December 1967 (with Pueschel)

"Air Monitoring to Determine the Impact of Highways on Air Quality," Department of Transportation, 1973-75, principal investigator

"Effects of Atmospheric Aerosol on Scattering Reflected Visible Light from Earth Resource Features," National Aeronautic and Space Administration, 1971-72, principal investigator

"Air Monitoring Instrument Calibration," Tennessee Department of Public Health, 1972-73, principal investigator

Registered professional engineer: Tennessee and California

Previous full-time professional experience: 11 yrs. (government)

Member, American Society of Civil Engineers
Member, Air Pollution Control Association
Consultant, National Aeronautics and Space Administration
Consultant, Tennessee Valley Authority
Consultant, State of California

DONALD E. OVERTON
Assistant Professor
Environmental Engineering Program
Civil Engineering Department
1972

BSAE	University of Maryland	Agricultural Engineering	1962
LLB	University of Maryland	Law	1966
MSCE	Georgia Institute of Technology	Civil Engineering	1968
PhD	University of Maryland	Civil Engineering	1972

Water resources systems analysis, urban hydrology, mechanics of ground and surface water flow

100% (75% teaching, 25% research)

"Route or Convolute?" Water Resources Research, 6, 1, pp. 43-52, February 1970

"A Least-Squares Hydrograph Analysis of Complex Storms on Small Agricultural Watersheds," Water Resources Research, 4, 5, pp. 955-963, October 1968

"Kinematic Flow on Long Impermeable Planes," Water Resources Bulletin, 8, 6, pp. 1198-1204, December 1972

"Estimation of Surface Water Lag Time from the Kinematic Wave Equations," Water Resources Bulletin, 7, 3, pp. 428-440, June 1971

"Shape Effects of Resistance in Flood-Plain Channels," Journal Hydraulics Division, American Society of Civil Enginers, 99, HY1, pp. 219-238, January 1973 (with Chin-lien Yen)

Previous full-time professional experience: 11 yrs. (research)

Consultant, US Water Resources Council (1971)

BRUCE A. TSCHANTZ
Associate Professor
Environmental Engineering Program
Civil Engineering Department
1965

BS	Ohio Northern University	Civil Engineering	1960
MS	New Mexico State University	Civil Engineering	1962
ScD	New Mexico State University	Civil Engineering	1965

Water resources transportation processes, hydraulics, hydrology, remote sensing applications, strip mine impacts

100% (67% teaching, 33% research)

The Inspection and Maintenance of Privately-Owned Dams in Tennessee, The University of Tennessee, Handbook, September 1972

"Safety Control of Small Dams in Tennessee," Report, The University of Tennessee Engineering Experiment Station, December 1971 (with K. N. Spencer)

"Interdisciplinary Approach to Floodplain Problems," American Society of Civil Engineers National Water Resources Meeting, Atlanta, Preprint 1598, January 1972 (with C. R. Wall)

"Remote Sensor Utilization for Environmental System Studies," US Air Force, 11/68-4/73, director and principal investigator

"Experimental Investigation of Hydraulic Transients in River-Reservoir Systems--Phases I, II, and III," Office of Water Resources Research, 7/68-6/70, principal investigator

Registered professional engineer: Ohio and Tennessee

Previous full-time professional experience: 2 yrs. (government)

Co-Chairman, 1974 National American Society of Civil Engineers Hydraulics Division Meeting (1972-date)
Member, Governor's Special Committee on Tennessee Dam Safety (1971-date)
Chairman, Southeastern Section, American Society for Engineering Education, Civil Engineering Division (1972-date)

WILLIAM J. BOEGLY
Associate Professor of Civil Engineering (part-time) and
Senior Researcher, Oak Ridge National Laboratory
PhD Purdue University Civil Engineering 1956
Solid waste management, radioactive waste management

FRANKLIN A. GIFFORD
Professor of Civil Engineering (part-time) and
Director, Air Resources Atmospheric Turbulence and Diffusion Laboratory,
National Oceanic and Atmospheric Administration, Oak Ridge
PhD Pennsylvania State University Meteorology 1955
Atmospheric diffusion and air pollution

STEVEN R. HANNA
Assistant Professor of Civil Engineering (part-time) and
Research Meteorologist, National Oceanic and Atmospheric Administration, Oak Ridge
PhD Pennsylvania State University Meteorology 1967
Atmospheric diffusion and air pollution

GARY A. BRIGGS
Assistant Professor of Civil Engineering (part-time) and
Research Meteorologist, National Oceanic and Atmospheric Administration, Oak Ridge
PhD Pennsylvania State University Meteorology 1971
Atmospheric diffusion and air pollution

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental	Master's	5	5	5	5	8	7	12	10	33	12	ENROLLMENT
Engineering	Doctoral	0	0	0	0	0	0	2	1	4	3	
Environmental	Master's	3		4		4		7		20		GRADUATES
Engineering	Doctoral	0		0		0		0		1		
Environmental	Master's	4		NON-US NATIONALS								
Engineering	Doctoral	3										

	Master's	Doctoral	
General Motors fellowship	2	0	SUPPORT
University fellowship	0	1	
Teaching assistantship	4	0	
Research assistantship	13	1	
Government employer	3	5	
Industrial employer	3	0	
Self-supported	8	0	
Consulting	50	0	EMPLOYMENT (%)
Industry	5	0	
Other government	5	0	
Further study	33	0	
Military	5	0	

Facilities

The University of Tennessee-Knoxville has complete basic labcratory facilities to support efforts in the areas of water and air quality analysis, air quality instrumentation calibration, water and wastewater treatment, and hydraulic and hydrologic analysis. Considerable facilities are available for field studies relating to both air and water quality, for example, trailer mounted ambient air quality instrumentation, two trailer mounted remote water quality monitors, three boats equipped for field studies. In addition, an airplane and appropriate instrumentation for remote sensing investigations are available. The proximity to and continuing cooperative arrangements with Oak Ridge National Laboratories and the Tennessee Valley Authority allow facilities to be made available for almost any conceivable environmental investigation. For example, numerous cooperative field investigations have been conducted with TVA using the extensive regulated river and reservoir system in the immediate area and there have been frequent cases of use of ORNL laboratory and library.

The University of Texas

Austin, Texas

Department of Civil Engineering
College of Engineering

Environmental Health Engineering

ECPD Accredited--Environmental Health Engineering

Dr. Joseph F. Malina, Jr., Director
Environmental Health Engineering
305 Engineering Labs Building
The University of Texas
Austin, TX 78712
(512) 471-5602

May 1973

The environmental health engineering program at The University of Texas at Austin provides for the education and training of engineers through curricula strong in the disciplines of related science and focusing on the practical engineering solutions of environmental problems. The program of graduate studies for each individual student includes a balanced combination of course work, seminars, and research. The courses available in air sampling and analysis, air pollution control, water pollution control, water resources, solid waste management, radiological health and environmental management provide flexibility in developing a graduate program. Satisfactory completion of an approved program of study leads to the MS or PhD degree.

The University of Texas at Austin is a state institution, created by the Constitution, located by popular vote, endowed and maintained by legislative grants. Tuition for residents of the State of Texas is $50 for 3 to 12 semester hours plus $73.75 for required fees during the regular semesters. During the summer session, tuition is $25 for 3 to 6 hours plus $33.75 for the required fees. The cost for out-of-state students is $40 per semester hour for tuition plus $73.75 for required fees. This tuition applies to each semester including summer. Research and teaching assistants and other students who work 20 hours per week are entitled to in-state tuition and fees.

The City of Austin has a population of 260,000 and is the State Capitol of Texas. The enrollment at The University of Texas is approximately 37,000 which includes 180 graduate students enrolled in the Department of Civil Engineering and 355 undergraduate students.

Admission Requirements

(a) 3.0/4 for undergraduates; 3.0/4 for graduate students.

(b) GRE of 1000 for MS; GRE of 1250 for PhD.

(c) Conditional admission is possible: Mid-carrier student with professional experience may be admitted.

(d) Foreign students must score 550 on TOEFL.

(e) Any engineering discipline at an accredited institution is acceptable. Individuals with undergraduate degrees in chemistry or biology also are acceptable, but may have to make up some course work.

(f) During the first semester, nonengineers must take for credit or demonstrate competence in engineering mechanics, fluid mechanics, differential equations, and undergraduate environmental health engineering courses in water and air pollution control.

(g) Applicants must have three letters of recommendation. Where applicable, professional experience is considered in evaluating the applicant.

(h) Individuals with advanced degrees in chemical and biological science may be admitted to the PhD program and make up deficiencies in mechanics, mathematics, and undergraduate environmental health engineering courses.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Health Engr.	30S[a]	Yes	No	2S	12
PhD--Civil Engr.[b]	-	Yes	Yes[c]	d	-

[a] Includes 6S of non-environmental health engineering courses and 6S of thesis.

[b] Students must perform satisfactorily in the comprehensive examination administered by the dissertation supervising committee and final oral defense of the dissertation.

[c] Proficient in one approved foreign language or have capability in computer sciences as determined by department.

[d] Two years beyond MS.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 384M	Industrial Hygiene & Toxicology	Journeay	-	S'73	20
CE 385K.1	Physical & Chemical Treatment of Water & Wastewater	Humenick	-	F'72	30
CE 385K.2	Stream & Estuarine Analysis I	Armstrong	-	F'72	27
CE 385K.2	Stream & Estuarine Analysis II	Armstrong	-	S'73	7
CE 385L	Biological Wastewater Treatment	Speece	-	F'72	25
CE 385M	Unit Operations in Water Poll. Control	Humenick	-	Su'73	7
CE 386M	Design of Water & Wastewater Systems	Ford	-	S'73	10

CE 388K	Envir. Health Engr. Principles	Speece	-	S'72	10
CE 388M	Radiological Health Principles	Ledbetter	-	S'73	7
CE 388N	Solid Waste Engineering	Malina	-	S'73	16
CE 390	Water Analysis	Fruh	-	F'72	8
CE 393M	Research Seminar	Malina	-	S'73	10
CE 396L.1	Air Pollution Sampling & Analysis	Ledbetter	-	F'72	10
CE 396L.2	Air Pollution Control	Ledbetter	-	S'73	16
CE 396L.3	Unit Operations in Air Cleaning	Ledbetter	-	S'72	8
CE 397.5	Industrial Wastewater Treatment	Gloyna	-	S'73	10
CE 397.5	Water Quality Management	Rohlich	-	S'72	30
CE 397.5	Envir. Impact to Power Plants	Rohlich	-	S'73	10
CE 397.56	Theoretical Approaches to Air Pollution Control	Black	-	F'72	6
CE 698a,b	Thesis	-	-	-	-
CE 699a,b	Dissertation	-	-	-	-
CE 341[1]	Envir. Pollution Control Engr.	Speece	-	S'73	60
CE 342[1]	Water Pollution Control	Humenick	-	S'73	20
CE 364[1]	Design of Water & Wastewater Treatment Plants	Rohlich	-	F'72	12
CE 369L[1]	Air Pollution & Industrial Hygiene	Black	-	S'73	20
CE 369M[1]	Solid & Industrial Waste Treatment	Speece	-	S'73	10
CE 370K[1]	Envir. Sampling & Analysis	Ledbetter	-	Su'73	-

[1] Undergraduate courses.

Faculty

JOSEPH F. MALINA, JR.
Professor of Civil Engineering;
Director of Environmental Health Engineering
Department of Civil Engineering
1961

BS	Manhattan College	Civil Engineering	1957
MS	University of Wisconsin	Civil Engineering	1959
PhD	University of Wisconsin	Sanitary Engineering	1961

Solid waste management, environmental health engineering, wastewater treatment, water reuse, viruses in water

100% (50% teaching, 25% research, 25% administration)

"Refuse, Reclamation and Recycle," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SA6, pp. 819-832, 1972 (with W. T. Morgan)

"Quantitative Procedure for Evaluating the Performance of Water and Wastewater Treatment Processes at Naturally Occurring Virus Levels," Environmental Science and Technology, 6, 5, pp. 438-441, 1972 (with C. A. Sorber and B. P. Sagik)

"Performance of Plastic Medium in Trickling Filters," Water Research, 6, 11, pp. 1321-1332, 1972 (with M. J. Gromiec and W. W. Eckenfelder)

"Viruses, Sewage, and Terrestrial Waste Disposal," National Science Foundation, 6/72-5/74, principal investigator

"Application of Oxygen to Treat Waste from Military Field Installations," US Army, 6/72-5/74, principal investigator

"Establishment of Operational Guidelines for Texas Coastal Zone Management," National Science Foundation, 6/72-5/74, co-principal investigator

Registered professional engineer: Texas

Previous full-time professional experience: 9 yrs. (academic)

Member, AEEP
Diplomate, AAEE
Member, American Institute of Chemical Engineers
Member, International Association of Water Pollution Research
Member, Water Pollution Control Federation
Member, American Society of Civil Engineers

JOE OVERTON LEDBETTER
Professor
Department of Civil Engineering
1959

BS	University of Alabama	Civil Engineering	1950
MS	The University of Texas	Sanitary Engineering	1958
PhD	The University of Texas	Civil Engineering	1963

Air pollution control, radiation shielding of broadbeam sources, radioactive waste disposal

100% (75% teaching, 25% research)

"The Jet Filter--A Single-Stage Size-Selective Sampler for Airborne Particulates," American Industrial Hygiene Association Journal, 33, 2, pp. 90-93, 1972 (with Birney R. Fish)

"Health Hazards from Wastewater Treatment Practices," Environmental Letters, 4, 3, pp. 225-232, 1973 (with L. M. Hauck and R. Reynolds)

Principles of Radiological Health, Marcel Dekker, Inc., New York, 1969 (with E. F. Gloyna)

Air Pollution Textbook--Part A: Analysis, Marcel Dekker, Inc., New York, 1972

"Training in Air Pollution Control," US Environmental Protection Agency, 7/70-6/73, co-principal investigator

"Principles of Radiological Health," US Environmental Protection Agency, 9/66-8/73, co-principal investigator

Registered professional engineer: Texas

Previous full-time professional experience: 24 yrs. (17 yrs. academic and 7 yrs. industry)

Member, Air Pollution Control Association
Member, American Industrial Hygiene Association
Member, American Conference of Governmental Industrial Hygienists

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RICHARD E. SPEECE
Professor
Department of Civil Engineering
1970

BS	Fenn College	-	1956
MS	Yale University	-	1958
PhD	Massachusetts Institute of Technology	-	1961

Biological wastewater treatment, oxygen application in water quality control, treatment and recycle of used fish hatchery water

100% (50% teaching, 50% research)

"Downflow Bubble Contact Aeration," Journal Sanitary Engineering Division, American Society of Civil Engineers, SA4, pp. 433-441, 1971 (with K. Needham)

"Hypolimnion Aeration," Journal American Water Works Association, 63, pp. 6-9, 1971

"The Effect of Short Term Temperature Variations of Methane Production," Journal Water Pollution Control Federation, 42, p. 1990, 1970 (with Jan Kem)

"Hypolimnion Aeration with Commercial Oxygen," US Environmental Protection Agency, 4/71-12/72, principal investigator

"Center of Competence for Abstracting Wastewater Literature," US Environmental Protection Agency, 2/71-8/72, principal investigator

Registered professional engineer: Texas and Illinois

Previous full-time professional experience: 17 yrs. (academic)

Member, American Water Works Association
Member, Water Pollution Control Federation
Member, American Society of Civil Engineers

GERARD A. ROHLICH
C. W. Cook Professor of Environmental Engineering
Department of Civil Engineering
1972

BS	University of Wisconsin	Civil Engineering	1936
MS	University of Wisconsin	Civil Engineering	1937
PhD	University of Wisconsin	Civil Engineering	1940

Lake and stream pollution, eutrophication, treatment of industrial wastes, water quality management, water resources

100% (70% teaching, 30% research)

"Wastewater Treatment and Eutrophication," American Society of Limnology and Oceanography, 1, pp. 231-243, 1972 (with P. D. Uttormark)

"Biostimulation and Algal Growth Kinetics of Wastewater," Journal Water Pollution Control Federation, pp. 455-473, 1971 (et al.)

"More Research Is Needed on Wastewater Treatment Techniques," The National Provisioner, No. 1970, pp. 164-173, 1970

Registered professional engineer: Texas, Wisconsin, and Pennsylvania

Previous full-time professional experience: 35 yrs. (26 yrs. academic and 9 yrs. industry)

Member, AEEP
Diplomate, AAEE
Member, Water Pollution Control Federation
Member, National Society of Professional Engineers
Member, American Society of Civil Engineers
Member, National Academy of Engineers

EARNEST F. GLOYNA
Joe King Professor of Engineering and
Dean of College of Engineering
1947

BS	Texas Technological University	Civil Engineering	1946
MS	The University of Texas	Sanitary Engineering	1949
DrEngr	The Johns Hopkins University	Sanitary Engineering	1952

Water resources, water and wastewater treatment, industrial waste control

100% (24% teaching, 9% research, 67% administration)

"Optimal Water Quality Management for the Houston Ship Channel," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SA1, pp. 195-214, 1972 (with A. J. Hays)

Conflicts in Water Resources Planning, Center for Research in Water Resources, The University of Texas at Austin, 1972 (with W. Butcher)

Water Quality Improvement by Physical and Chemical Processes, The University of Texas Press, Austin and London, 1970 (with W. W. Eckenfelder)

"Hazardous Material Spills," US Environmental Protection Agency, 2/73-2/74, co-principal investigator

"Instrumentation for Engineering Management of a Multi-Purpose River System," Office of Water Resources Research, 10/70-8/73, principal investigator

Filtration of Oil," Graphilter Corporation, 1971-74, principal investigator

Registered professional engineer: Texas

Previous full-time professional experience: 36 yrs. (26 yrs. academic and 10 yrs. industry)

Member, AEEP
Diplomate, AAEE
Member, National Academy of Engineers
Vice Chairman, Board of Directors, Environmental Engineering Intersociety Board
Member, US Public Health Service, Environmental Health Review Committee
Member, Water Pollution Control Federation
Member, American Society of Civil Engineers

E. GUS FRUH
Associate Professor
Department of Civil Engineering
1965

BS	Manhattan College	Civil Engineering	1961
MS	University of Wisconsin	Sanitary Engineering	1963
PhD	University of Wisconsin	Sanitary Engineering	1965

Management of water quality impoundments and estuaries, eutrophication and water quality

100% (50% teaching, 50% research)

"A Conceptual Report on the Management of Bay and Estuarine Systems--Phase I," Report to National Science Foundation, 1972 (et al.)

"Nutrient Studies in Texas," Journal Water Pollution Control Federation, 1972 (with V. H. Huang and R. S. Mase)

"Before and After Studies of the Effects of a Power Plant Installation on Lake LBJ--Measurement and Prediction of Abnormal Reservoir Operations on Lake LBJ's Water Quality," Progress Report to Lower Colorado River Authority, 1972 (with C. W. Bullock)

"Establishment of Operational Guidelines for Texas Coastal Zone Management," National Science Foundation, 6/72-5/74, co-principal investigator

"Selective Withdrawal at Lake Livingston," Office of Water Resources Research, 1/69-12/72, principal investigator

"Before and After Studies on Thermal Discharges into Lake LBJ," Lower Colorado River Authority, 1/71-12/74, principal investigator

Registered professional engineer: Texas

Member, AEEP
Member, Water Pollution Control Federation
Member, National Science Foundation Site Visit Team
Member, American Society of Civil Engineers
Member, Water Program Review Committee, US Environmental Protection Agency

NEAL E. ARMSTRONG
Associate Professor
Department of Civil Engineering
1971

BS	The University of Texas	Zoology	1962
MS	The University of Texas	Zoology	1965
PhD	The University of Texas	Civil Engineering	1968

Ocean engineering, management of water quality of estuaries and marine systems, ecology of estuaries in coastal waters

50% (25% teaching, 25% research)

"Water Quality for Ecological Stability," in Conflicts in Water Resources Planning--What Are the Remedies," Special Lecture Series No. 5 held at The University of Texas at Austin, 1970

"Ecological Aspects of Stream Pollution," Advances in Water Quality Improvement, Water Resources Symposium No. 1, The University of Texas Press, 1968 (with E. F. Gloyna and B. J. Copeland)

"Significance of Ecological Factors in Estuarine Water Quality Assessment--Jamaica Bay Study," Proceedings, 5th International Conference on Water Pollution Research, San Francisco, 1970 (with David Eckhoff and Martin Lang)

"Hazardous Material Spills," US Environmental Protection Agency, 2/73-2/74, principal investigator

"Coastal Canal Studies," Texas Water Development Board, 8/72-7/73, principal investigator

Registered professional engineer: Texas

Previous full-time professional experience: 4 yrs. (industry)

Member, Water Pollution Control Federation
Member, American Association for the Advancement of Science
Member, Society of Limnology and Oceanography

MICHAEL J. HUMENICK
Associate Professor
Department of Civil Engineering
1970

BS	University of Michigan	Civil Engineering	1959
MS	University of Michigan	Civil Engineering	1959
PhD	University of California-Berkeley	Civil Engineering	1970

Water and wastewater treatment; advanced treatment processes; physical, chemical, and biological processing of waters and wastewaters

100% (50% teaching, 50% research)

"Comparison of Air and Oxygen Activated Sludge Kinetics and Settleability," Water Resources Symposium No. 6 sponsored by Environmental Health Engineering and the Center for Research in Water Resources, The University of Texas at Austin, 1972 (with J. E. Ball)

"Activated Sludge Kinetics and Settleability under Aeration and Oxygenation," Journal Water Pollution Control Federation, 1972 (with R. E. Speece)

"High-Purity Oxygen in Biological Treatment of Municipal Wastewater," Journal Water Pollution Control Federation, 44, 65, 1972 (with J. E. Ball)

"Texas Electric Service," Texas Electric Service Corporation, 2/72-6/73, co-principal investigator

Registered professional engineer: Texas

Previous full-time professional experience: 10 yrs. (3 yrs. academic and 7 yrs. industry)

Member, American Institute of Chemical Engineers
Member, American Society of Civil Engineers
Member, California Water Pollution Control Federation

ORVILLE WYSS
Professor of Microbiology
PhD The University of Wisconsin Biochemistry & Microbiology 1941
Public health, microbiology

ALLEN BARD
Professor of Chemistry
PhD Harvard University Chemistry 1958
Analytical chemistry

BASSETT MAGUIRE
Associate Professor of Zoology
PhD Cornell University Aquatic Ecology 1957
Oceanography, man and environment, ecology, limnology, modeling, structure, and function of biological communities

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BERNARD SAGIK
Professor of Microbiology
PhD University of Illinois Microbiology 1952
Virology, inactivation of viruses in natural environments

CLARK HUBBS
Professor of Zoology
PhD Stanford University Biology 1951
Ecology of fish, thermal tolerance of larvae stage of fishes

JOSEPH LAGOWSKI
Professor of Chemistry
PhD Cambridge University Chemistry 1959
Computer-assisted education, inorganic chemistry

LELAND TURK
Associate Professor of Geology
PhD Stanford University Geology 1959
Environmental geology

WILLIAM FISHER
Professor and Director, Bureau of Economic Geology
PhD University of Kansas Geology 1961
Environmental geology

WILLIAM LESSO
Associate Professor of Mechanical Engineering
PhD Case Institute of Technology Operations Research 1967
Operations research, management science, project management, project investment analysis

DAVID HIMMELBLAU
Professor of Chemical Engineering
PhD University of Washington Chemical Engineering 1957
Process analysis and simulation modeling, interphase mass transfer

CORWIN JOHNSON
Professor of Law
JD University of Iowa Law 1941
Environmental law

WILLIAM BUTCHER
Associate Professor of Civil Engineering
PhD University of Southern California Civil Engineering 1969
Water resources planning and management

JAMES BROCK
Professor of Chemical Engineering
PhD University of Wisconsin Chemical Engineering 1960
Aerosol physics and chemistry, air pollution, statistical physics, environmental sciences

FRANK MASCH
Professor of Civil Engineering
PhD University of California Civil Engineering 1962
Coastal and estuarine engineering, mixing and dispersion, computer applications

JAMES DAILEY
Assistant Professor of Civil Engineering
PhD Massachusetts Institute of Technology Oceanography 1972
Ocean engineering, water resources

ALBERT NOYES
Professor of Chemistry
D es Sc University of Paris Physical Chemistry 1920
Photochemical reactions

Students

		68-69 FT PT	69-70 FT PT	70-71 FT PT	71-72 FT PT	72-73 FT PT	
Environmental Health	Master's	29	27	36	50	46	ENROLLMENT
Engineering	Doctoral	22	27	23	18	13	
Environmental Health	Master's	12	14	23	23	34	GRADUATES
Engineering	Doctoral	7	6	4	6	- -	
Environmental Health	Master's	6	NON-US NATIONALS				
Engineering	Doctoral	3					

	Master's	Doctoral	
EPA traineeship	18	0	
Research assistantships	4	4	
Teaching assistantships	1	1	
Other university support	1	0	SUPPORT
Industrial fellowship	0	1	
Foundation support	0	1	
Government employer	3	2	

	Master's & Doctoral	
Consulting	17	
R & D	5	
Industry	12	
Federal government	14	
Other government	19	EMPLOYMENT (%)
Academic	17	
Further study	5	
Military	8	
Outside environmental area	2	
Unknown	1	

Facilities

On campus a 10,000 square foot laboratory and office complex includes a wet chemistry laboratory; facilities for air pollution, water pollution, and solid waste unit operations; microbiology and virology laboratory, controlled temperature rooms, algal culture facilities, instrumentation laboratories, low-level radioactivity laboratory, "clean" chemistry and radioisotope handling area, and environmental control rooms. The laboratories are designed and equipped for teaching and bench-scale and laboratory research. Atomic absorption, visible and ultraviolet and infrared spectrophotometers, autoanalyzers, carbon analyzers, total oxygen demand analyzers, gas chromatographs, optical particle counters, and radioactivity counters are among the analytical instrumentation in use. Each student is provided with a study area and desk. The Steel Reading Room has current periodicals and reports specifically for student's use.

Approximately 28,000 square feet of laboratory space will be available to the environmental health engineering program in a new Engineering Teaching Center which is under construction on the main campus and scheduled for occupancy in February 1974.

The CDC Computer and auxilliary equipment are located at the Central Computation Center. Access to this computer capability is available through remote terminals. The Center for Research in Water Resources at the Balcones Research Center and the Marine Sciences Institute at Port Aransas are close to the campus. Also the Bureau of Economic Geology on campus as well as the facilities of state agencies and of the City of Austin Water and Wastewater Treatment Division have been used by faculty and students on specific projects.

Texas A&M University

College Station, Texas

Environmental Engineering Division
Civil Engineering Department
College of Engineering

Environmental Engineering
Environmental Sciences

Dr. Roy W. Hann, Jr.
Professor and Head
Environmental Engineering Division
Texas A&M University
College Station, TX 77843
(713) 845-3011

May 1973

Environmental engineering is a broad-based, interdisciplinary program concerned with minimizing the adverse effects of man's activities on the environment. Graduate study in environmental engineering is offered through the Civil Engineering Department. The program of study offers the MS, ME, and PhD degrees in civil engineering with a major in environmental engineering and environmental sciences. Students majoring in the program should have prior degrees in science or engineering.

Research interests within the Division include aquatic systems analysis, water resources, surface and groundwater quality and criteria, advanced waste treatment, remote sensing, air quality control, aquatic biology, chemical oceanography, and solid waste.

Regular tuition is $4 per credit hour. Additional fees and services are approximately $60 per semester. The Environmental Engineering Division can provide financial support in several ways depending on the student's academic record and interests.

Admission Requirements

(a) 2.75/4 for MS and ME; 3.0/4 for PhD.

(b) GRE of 1000 combined for MS or ME or PhD. Advanced examination is not required.

(c) Admission to the graduate program is possible for GPA less than minimum if applicant has good references and work experience.

(d) Foreign students must score a minimum of 550 on TOEFL and a GRE of 800 to be admitted.

(e) Any engineering or science discipline at an accredited institution is acceptable.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
ME	36S	No	No	1S	12
MS	30S	Yes	No	1S	12
PhD	Varies	Yes	No	1 yr.	24

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 603	Stream Quality	Hann	3S	-	-
CE 604	Intro. to Unit Operation Theory	Reynolds Wolf Ball	3S	-	-
CE 605	Experimental Analysis in Environmental Engineering	Slowey Hann	3S	-	-
CE 606	Design of Advanced Waste Treatment Systems	Ball Reynolds	3S	-	-
CE 606A[1]	Design of Advanced Waste Treatment Processes	Wolf Reynolds Ball	-	-	-
CE 607	Environmental Engineering Analysis for Urban Areas	Hughes Cooper	3S	-	-
CE 608	Environmental Engineering Design for Urban Areas	Hughes Cooper Woods	3S	-	-
CE 609	Simulation of Water Resources Systems for Numerical Analysis	Hann Sparr	3S	-	-
CE 610	Industrial Wastes	Ball Wood Reynolds	3S	-	-
CE 611	Design of Potable & Industrial Water Systems	Ball Reynolds	3S	-	-
CE 664	Water Resources Development	Hann James Woods	3S	-	-

CE 680	Civil Engineering Computer Systems	Hann Hughes	3S	-	-
CE 690[1]	Introduction to Air Pollution	Hughes Cooper	3S	-	-
CE 692[1]	Experimental Analysis in Environmental Engineering	Hughes Cooper	-	-	-
CE 695	Control of Atmospheric Emissions	Hughes Cooper	-	-	-

[1] To be included in subsequent graduate catalogs.

Faculty

ROY W. HANN, JR.
Professor and Head, Environmental Engineering Division
Civil Engineering Department
1965

BS	University of Oklahoma	Civil Engineering	1956
MS	University of Oklahoma	Civil Engineering	1957
PhD	University of Oklahoma	Engineering Science	1963

Water and air quality, water resources, environmental management, estuarine systems analysis, mathematical modeling

100% (33% teaching, 33% research, 33% administration)

"Management of Industrial Waste Discharges in Complex Estuarine Systems," US Environmental Protection Agency, current, principal investigator

"Control of Hazardous Materials in the Coastal Zone," National Oceanic and Atmospheric Administration's Office of Sea Grant, current, principal investigator

"Environmental Quality Enhancement of Texas Estuaries," National Oceanic and Atmospheric Administration's Office of Sea Grant, current, principal investigator

Registered professional engineer: Oklahoma and Texas

Previous full-time professional experience: 5 yrs. (2 yrs. academic, 1 yr. consulting, and 2 yrs. government)

Member, AEEP
Member, National Academy of Science; Member, Committee on Hazardous Materials
Member, United Nations Ad Hoc Panel of GESAMP to Review the Environmental Hazards of Substances Other than Oil Transported by Ships

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HAROLD W. WOLF
Professor, Environmental Engineering Division
Civil Engineering Department
1970

BS	State University of Iowa	Civil Engineering	1949
MSH	State University of Iowa	Sanitary Engineering & Hygiene	1950
DrPH	University of California-Los Angeles	Environmental Health	1965

Environmental health, water quality standards, advanced waste treatment techniques

100% (10% teaching, 80% research, 10% administration)

"Advanced Waste Treatment Training Grant," US Environmental Protection Agency, current, principal investigator

"Dallas Water Reclamation Project," City of Dallas, Texas, current, principal investigator

"Water Resources Institute Water Quality Criteria," Office of Water Resources Research, current, principal investigator

Registered professional engineer: Texas

Previous full-time professional experience: 20 yrs. (government)

Member, Mercury Advisory Committee, US Environmental Protection Agency
Member, Committee for Identification of Research Needs in Water Supply, US Environmental Protection Agency
Member, Water Pollution Control Federation; Member, Water Reuse Committee

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CALVIN E. WOODS
Professor, Environmental Engineering Division
Civil Engineering Department
1972

BS	University of Houston	Civil Engineering	1955
MS	University of Colorado	Civil Engineering	1959
PhD	University of Texas at Austin	Civil Engineering	1964

Water resources, groundwater

100% (50% teaching, 50% research)

"Fate of Metals Applied in Sewage to Land Wastewater Disposal Sites," US Army Medical Service, current, principal investigator

"Groundwater Resources in the Seymour Formation, Haskell and Knox Counties, Texas," Texas Water Quality Board, current, principal investigator

Registered professional engineer: Texas, Louisiana, New Mexico, and Alaska

Previous full-time professional experience: 15 yrs. (12 yrs. academic and 3 yrs. industry)

Member, AEEP
Member, Technical Advisory Committee, Texas Air Quality Control Board (1971-date)

TOM D. REYNOLDS
Associate Professor, Environmental Engineering Division
Civil Engineering Department
1967

BS	Texas A&M University	Civil Engineering	1950
MS	University of Texas	Sanitary Engineering	1961
PhD	University of Texas	Environmental Health Engineering	1963

Biological waste treatment, unit operations, advanced waste treatment processes

100% (50% teaching, 50% research)

Registered professional engineer: Texas

Previous full-time professional experience: 11 yrs. (4 yrs. academic and 7 yrs. consulting)

Member, AEEP

WESLEY P. JAMES
Assistant Professor, Environmental Engineering Division
Civil Engineering Department
1971

BS	Montana State University	Civil Engineering	1957
MS	Purdue University	Civil Engineering	1961
PhD	Oregon State University	Civil Engineering	1970

Water resources, coastal pollution, remote sensing, photogrammetry, computer applications

100% (50% teaching, 50% research)

"SEADOCK," Seadock, Inc., current, co-principal investigator

"Supertanker Environmental Impact Study," National Oceanic and Atmospheric Administration's Office of Sea Grants, current, principal investigator

Registered professional engineer: Wyoming, Oregon, Montana, and Texas

Previous full-time professional experience: 5 yrs. (1 yr. academic and 4 yrs. industry)

Member, AEEP
Member, American Society of Civil Engineers; Chairman, Interdivision and Interdisciplinary Coordination Committee of the Aerospace Technical Council
Member, American Water Works Association; Member, Student Activities Committee

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RICHARD C. ALLISON
Assistant Professor, Environmental Engineering Division
Civil Engineering Department
1970

BA	North Texas State University	Biology-Chemistry	1960
MA	North Texas State University	Biology	1966
PhD	Texas A&M University	Civil Engineering	1970

Aquatic biology, ecology, water and wastewater treatment, algal growth

100% (30% teaching, 70% research)

Previous full-time professional experience: 3 yrs. (industry)

J. MARTIN HUGHES
Assistant Professor, Environmental Engineering Division
Civil Engineering Department
1969

BS	Oklahoma State University	Mechanical Engineering	1961
MS	Oklahoma State University	Mechanical Engineering	1963
PhD	University of Illinois	Mechanical Engineering	1972

Air pollution, especially particle dynamics

100% (50% teaching, 50% research)

"Cottonseed Oil Mill Air Pollution Control," National Cottonseed Products Association and Texas Cottonseed Crushers Association, 1972, principal investigator

Registered professional engineer: Illinois and Texas

Previous full-time professional experience: 2 yrs. (industry)

Member, AEEP

HAL B. H. COOPER, JR.
Assistant Professor, Environmental Engineering Division
Civil Engineering Department
1972

BS	University of California	Chemical Engineering	1963
MS	University of Washington	Civil Engineering	1966
PhD	University of Washington	Civil Engineering	1972

Air pollution control, wastewater treatment, solid waste disposal

100% (50% teaching, 50% research)

Previous full-time professional experience: 4 yrs. (industry)

JOHN E. BALL
Assistant Professor, Environmental Engineering Division
Civil Engineering Department
1972

BS	University of Florida	Civil Engineering	1962
MS	University of Florida	Civil Engineering	1968
PhD	University of Texas	Environmental Engineering	1972

Industrial and municipal water and wastewater treatment, nutrient enrichment and primary productivity, oil-water emulsions, aeration and oxygenation

100% (40% teaching, 40% research, 20% administration)

"Nutrient Limitations in Texas Watersheds," Texas Water Quality Board, current, principal investigator

"Total Organic Carbon as a Permit and Monitoring Parameter," Texas Water Quality Board, current principal investigator

Registered professional engineer: Texas and Florida

Previous full-time professional experience: 7 yrs. (6 yrs. industry and 1 yr. government)

NEILL C. BURNETT
Engineering Research Associate, Environmental Engineering Division
Civil Engineering Department
1972

BA	Howard College (Samford University)	General Science	1948
MS	University of Wisconsin	Microbiology	1962
PhD	University of Kansas	Environmental Health Science	1972

Biological waste treatment systems, solid waste management

100% (20% teaching, 80% research)

Previous full-time professional experience: 6 yrs. (government)

STEWART B. CARPENTER
Systems Analyst, Environmental Engineering Division
Civil Engineering Department
1972

BA	Texas A&M University	Mathematics	1962
MCS	Texas A&M University	Computing Science	1968
PhD	Texas A&M University	Computing Science	1972

Water resources modeling, storage and retrieval systems, computer language design

100% (20% teaching, 80% research)

Previous full-time professional experience: 3 yrs. (government)

J. FRANK SLOWEY
Associate Research Chemist, Environmental Engineering Division
Civil Engineering Department
1971

BS	Texas A&M University	Chemistry	1951
MS	Texas A&M University	Chemical Oceanography	1960
PhD	Texas A&M University	Chemical Oceanography	1966

Water quality chemistry, heavy metal chemistry, geochemistry of natural waters, chemical oceanography

100% (20% teaching, 80% research)

"Natural Background Levels of Heavy Metals in Texas Estuarine Sediments," Texas Water Quality Board, current, principal investigator

"Removal, Treatment and Disposal of Sediments Containing Industrial Wastes," National Oceanic and Atmospheric Administration's Office of Sea Grants, current, principal investigator

Previous full-time professional experience: 10 yrs. (4 yrs. academic, 2 yrs. industry, and 4 yrs. government)

TED M. SPARR
Systems Analyst, Environmental Engineering Division
Civil Engineering Department
1972

BA	Ohio Wesleyan University	Mathematics	1963
MS	Texas A&M University	Computing Science	1969
PhD	Texas A&M University	Computing Science	1972

Water quality monitoring and surveillance systems, environmental resources data storage and retrieval systems, environmental engineering computer systems and applications, computer operating systems design

100% (20% teaching, 80% research)

"The Use of Analytical Models, Hydrology and Statistical Concepts in Setting, Reviewing and Upgrading Water Quality Standards and Criteria," Texas Water Quality Board, current, principal investigator

Previous full-time professional experience: 1 yr. (research)

DAVID R. BASCO
Assistant Professor
Civil Engineering Department
1969

BS	University of Wisconsin	Civil Engineering	1960
MS	University of Wisconsin	Civil Engineering	1962
PhD	Lehigh University	Civil Engineering	1970

Fluid mechanics and hydraulic engineering (applications to environmental problems), hydraulics, water resources, turbo machinery, dredging, fluid mechanics, hydraulic structures, coastal engineering

100% (50% teaching, 50% research)

Registered professional engineer: Texas and Mississippi

Previous full-time professional experience: 9 yrs. (3 yrs. academic, 3 yrs. government, and 3 yrs. industry)

Member, American Society of Civil Engineers; President, Brazos Branch, Texas Section; Member, Hydromechanics Committee
Member, World Dredging Association; Member, Ecology Committee

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GLEN N. WILLIAMS
Assistant Professor
Industrial Engineering Department
1969

BS	Texas A&M University	Civil Engineering	1960
ME	Texas A&M University	Civil Engineering	1961
PhD	Texas A&M University	Civil Engineering	1965

Numerical analysis, computer applications

100% (50% teaching, 50% research)

Registered professional engineer: Texas

Previous full-time professional experience: 4 yrs. (industry)

Students

		68-69 FT PT	69-70 FT PT	70-71 FT PT	71-72 FT PT	72-73 FFT PT	
Environmental	Master's	-	-	-	5	8	ENROLLMENT
Engineering	Doctoral	-	-	-	7	11	
Environmental	Master's	-	-	-	5	3	GRADUATES
Engineering	Doctoral	-	-	-	3	2	
Environmental	Master's	2	NON-US NATIONALS				
Engineering	Doctoral	1					

	Master's	Doctoral	
EPA traineeships	7	0	SUPPORT
Research assistantships	1	11	

Facilities

Over 15,000 square feet of space is devoted to environmental engineering laboratories within the Civil Engineering Department. These laboratories are fully equipped with modern instruments including infrared spectrophotometers, gas chromatographs, and atomic absorption spectrophotometers. In addition, the Division operates a pilot treatment plant and a research laboratory at the University's new waste treatment plant.

The Environmental Engineering Division operates three modern, fully-equipped research vessels all over 50 feet in length. Scientific instruments on board include water quality monitoring systems, overboard pumping systems, fluorometers, a total carbon analyzer, an oxygraph, samplers, velocity meters, and corers. The research laboratory including a supporting shore facility is located at Morgan's Point on the Houston Ship Channel-Galveston Bay complex.

University of Toronto

Toronto, Ontario

Department of Civil Engineering
Faculty of Applied Science and Engineering

Environmental (Sanitary) Engineering

Professor T. C. Kenney, Chairman
Department of Civil Engineering
University of Toronto
Toronto, Ontario M5S 1A4
(416) 928-3486

April 1973

The PhD and MASc degrees in environmental (sanitary) engineering are research-oriented degrees whereas the MEng degree is more of an applied nature with course work and project emphasis. The MEng degree may be taken on a part-time basis extending over no more than four years. Some of the courses are offered in the evening to facilitate participation by part-time students.

The program emphasis is in the area of wastewater treatment including industrial and municipal effluents. By cooperation with other departments, programs in air pollution and solid waste management can be arranged.

The engineering faculty at the University of Toronto is 100 years old this year (1973). The Department of Civil Engineering graduate student enrollment for the 1972-73 session was 161. The environmental engineering group was 33, comprising 15 full-time Master's students, 13 part-time, and 5 doctoral students.

Very close cooperation is enjoyed with the Institute of Environmental Sciences and Engineering, a university-wide interdisciplinary group engaged in graduate teaching and research on problems of an environmental nature. The Institute provides real access to a wide variety of other staff and facilities within the University community.

Estimates of cost-of-living in Toronto for a single student for the eight-month academic session (September to May 1973-74) are approximately $2,000. The University is located in the heart of the City of Toronto, which has a population of close to 2 million people and enjoys a wide variety of cultural and sports opportunities. By and large, Toronto is considered by visitors to be remarkably free from social unrest so common nowadays in large metropolitan centers.

Admission Requirements

(a) 3.0 or equivalent of a second class Canadian degree in civil engineering.

(b) GRE is not used as an admission criterion.

(c) Provisional admission is possible upon completion of undergraduate degree maintaining at least a B average.

(d) Foreign students must score 530 on TOEFL.

(e) Any engineering discipline at an accredited institution is acceptable, although more than the usual time and number of courses may be required.

(f) It is unlikely that nonengineers would be accepted.

(g) References may be required.

(h) PhD requirements: student's work in Master's degree must be known to someone on faculty if not from Canadian or United States university.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MEng	16-20[a]	Optional[b]	No	None	16-20[c]
MASc	12-16[a]	Yes	No	1 Ses.	16-20[c]
PhD[d]	-	Yes	No	2 Ses.[e]	48[f]

[a] Not including thesis credits (total units--24).

[b] Thesis or project.

[c] Full-time; part-time--four years.

[d] Major requirement is thesis based on a program of original research, also study of major area plus two minor areas.

[e] Beyond Master's degree.

[f] Must be completed within six years.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
1006X	Adv. Concepts in Envir. Engr. Design	Henry	2 units	New'74	-
1007X	Water Pollution Control Engr.	Henry	2 units	F'72	0
1008X	Unit Oper. & Proc. of San. Engr. I	Heinke	3 units	F'72	7
1009X	Unit Oper. & Proc. of San. Engr. II	Ganczarczyk	2 units	F'72	8
1012X	Environmental Control	Bernhart	2 units	F'72	4
1013X	Sanitary Microbiology	Jones	2 units	F'72	10
1014X	Industrial Wastewater Control	Ganczarczyk	3 units	F&S'72-73	7
1015X	Sanitary Biochemistry	Jones Staff	2 units	S'73	0

1017X	Air Pollution Control Engineering	Bernhart	2 units	S'73	8
1019X	Water Chemistry & Water & WW Analysis	Ganczarczyk	3 units	F&S'72-73	7
1049X	Surface & Ground Water	Rodgers	2 units	S'73	7
1086X	Water Resources & Hydrology	Albery	2 units	F'72	0
1099X	Special Studies in Civil Engr.	-	1-4 units	-	-

X indicates half course.

Faculty

PHILIP HARRHY JONES
Chairman, Institute of Environmental Sciences and Engineering
Professor of Civil Engineering, Professor of Microbiology
1964

BASc	University of Toronto	Civil Engineering	1958
MS	Northwestern University	Sanitary Engineering	1963
PhD	Northwestern University	Sanitary Engineering	1965

Microbiology of water and wastewater treatment, municipal wastes, high strength animal wastes

100% (20% teaching, 30% research, 50% administration)

"The Use of Tetrazolium Salts as a Measure of Sludge Activity," Journal Water Pollution Control Federation, pp. 441-449, November 1969 (with D. Prasad)

"Yeast Production Using Conventional Activated Sludge Methods for Treatment of Corn Processing Industrial Wastes," Proceedings, 3rd Canadian Symposium on Water Pollution Research, University of Toronto, 1968 (with W. F. Milbury and T. W. Riedel)

"Variation in Cell Yield," presented 7th Canadian Symposium on Water Pollution Research, McMaster University, Hamilton, Ontario, 1972 (with J. G. Henry)

"A Mathematical Model for Contact Stabilization," Proceedings, 5th International Conference on Water Pollution Research, San Francisco, 1970

"The Fate of Nitrogen and Phosphorus in an Oxidation Ditch Treating Swine Wastes," presented 45th Annual Conference, Water Pollution Control Federation, Atlanta, 1972 (with N. K. Patni)

"Partial Nutrient Removal at the Penetanguishene Sewage Treatment Plant," Canada Centre for Inland Waters (Department of Energy, Mines and Resources--now Environment Canada), 11/70-3/31/71, principal investigator

"Animal Waste Disposal," Ontario Department of Agriculture and Food, 12/70-6/72, principal investigator

"Optimization of Activated Sludge Waste Water Treatment Processes," National Research Council, 1969-71, principal investigator

Registered professional engineer: Ontario, Canada

Previous full-time professional experience: 6 yrs. (1 yr. industry and 5 yrs. government)

Member, AEEP
Technical Director, International Committee of Water Pollution Research
Member, Public Health Engineering Advisory Committee, National Health and Welfare
Chairman, York Chapter of Association of Professional Engineers of the Province of Ontario (1961-62)

GERHARD W. HEINKE
Associate Professor
Department of Civil Engineering
1962

Bachelor's	University of Toronto	Civil Engineering	1956
Master's	University of Toronto	Civil Engineering	1961
Doctorate	McMaster University, Hamilton	Chemical Engineering	1969

Arctic environmental engineering, effect of low temperatures on waste treatment, phosphate removal from wastewater, hydrolysis of condensed phosphates

100%

"Vacuum Sewer Systems," publication of the Department of Indian Affairs and Northern Development, Ottawa, 1973 (with D. W. Averill)

"Evaluation of the Sewage Lagoon at Inuvik, N. W. T.," publication of the Department of Indian Affairs and Northern Development, Ottawa, 1973 (with H. K. Miyamoto and N. A. Jacobsen)

"Bibliography of Arctic Environmental Engineering," publication of the Department of Indian Affairs and Northern Development, Ottawa, 1973

"Report on Municipal Services in Communities of the Northwest Territories," publication of the Department of Indian Affairs and Northern Development, Ottawa, 1973

"Water Supply and Waste Disposal for Frobisher Bay, N. W. T.--A Conceptual Look at Alternate Systems," publication of the Department of Indian Affairs and Northern Development, Ottawa, 1973 (with B. Deans)

Registered professional engineer: Toronto, Ontario

Previous full-time professional experience: approximately 13 yrs.

Member, AEEP
Member, American Water Works Association
Member, Canadian Institute of Pollution Control
Member, Engineering Institute of Canada

JERZY GANCZARCZYK
Associate Professor
Department of Civil Engineering
1969

MASc	Technical University (Gliwice, Pohland)	Chemical Engineering	1950
DSc	Technical University (Gliwice, Pohland)	Sanitary Engineering	1956
Docent Habilit	Technical University (Warsaw, Pohland)	Sanitary Engineering	1962

Teaching of wastewater treatment technology, recent research on aerobic digestion, mineral nutrients and organics releases, mineral substances elimination, physical behaviour of activated sludge flocs and mechanisms of lignin transformations

100%

"Biological Removal of Lignin from Kraft Mill Effluents, II: Changes in Molecular Size Distribution," University of Toronto, Department of Civil Engineering, Publication 72-08, 1972 (with T. Obiaga)

"Fate of Lignin in Activated Sludge Treatment of Kraft Effluents," University of Toronto, Department of Civil Engineering, Publication 72-02, 1972

"Foaming of Sulfite Pulp Mill Effluents." paper presented at 15th Conference on Great Lakes Research, Madison, Wisconsin, 1972

"The Influence of Simple Phenols on Water Aeration Kinetics," Canadian Journal of Chemical Engineering, 50, 4, pp. 185-188, 1972

"Biological Removal of Lignin from Kraft Mill Effluents, I: Preliminary Studies," University of Toronto, Department of Civil Engineering, Publication 71-604, 1971 (with R. E. Anderson

"Aerobic Digestion of Organic Sludges Containing Inorganic Phosphorus Precipitates"

"Mineral Nutrients and Organics Releases by Biological Systems due to the Changes in Environmental Factors"

"Mineral Substances Elimination from Wastewater by the Route of Surplus Activated Sludge"

Registered professional engineer: Toronto, Ontario

Previous full-time professional experience: 19 yrs.

Member, AEEP
Member, Pollution Control Association of Ontario
Member, International Association on Water Pollution Research
Member, International Association for Great Lakes Research
Expert on environmental health engineering of the United Nations World Health Organization

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ALFRED P. BERNHART
Associate Professor
Department of Civil Engineering
1961

Dipl Ing(BASc)	University of Graz (Austria)	Civil Engineering	1936
DSc	University of Graz (Austria)	Civil Engineering	1950

Soil infiltration and evapotranspiration of wastewater, air pollution control human values in the environment

100% (66% teaching, 22% research, 12% administration)

"Protection of Water Supply Wells from Contamination by Wastewater," Groundwater, June 1973

"Treatment and Disposal of Wastewater from Homes," booklet, 1967 and 1973

"Seven Dimensional Theory for the Shaping of Metropolis," Engineering Journal, March 1966

Registered professional engineer: Toronto, Ontario

Previous full-time professional experience: 22 yrs. (7 yrs. consulting, 3 yrs. government, and 12 yrs. industry)

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Civil Engineering	Master's	10	3	10	7	13	7	15	18	15	13	ENROLLMENT
(Sanitary)	Doctoral	3	0	3	0	4	0	3	3	5	0	
Civil Engineering	Master's	9		5		6		11		3		GRADUATES
(Sanitary)	Doctoral	-		-		2		-		-		

Facilities

The research and teaching facilities for the environmental field of study are equipped to make biological, chemical, and physical determinations. Temperature controlled facilities are available for all research requiring this feature. The Department also has at its disposal for research purposes a 350,000 gallon per day activated sludge sewage treatment plant which has a laboratory and can be equipped to perform whatever determinations are required for any specific research project.

The University-based laboratories are fully equipped and cover an area of about 10,000 square feet. Workshops are available for the development of the special equipment required for specific research projects on control of pollution of air, water, and soil. Due to a close affiliation with the Great Lakes Division of the Institute of Environmental Science and Engineering, one large ship and five launches are available for conducting research in the field of water quality.

Through affiliation with the School of Hygiene of this University, the Department of Civil Engineering has access to sanitary microbiology laboratories equipped for advanced studies in the microbiology of water and wastewater treatment. Further, a mobile water and wastewater chemical and biological laboratory is available and can be equipped in whatever manner may be required for any specific research project.

Tufts University

Medford, Massachusetts

Department of Civil Engineering
College of Engineering

Environmental Health Engineering

Dr. N. Bruce Hanes
Program Director and Chairman
Department of Civil Engineering
Anderson Hall
Tufts University
Medford, MA 02155
(617) 628-5000 x442

Dr. Linfield C. Brown
Assistant Professor
Department of Civil Engineering
Anderson Hall
Tufts University
Medford, MA 02155
(617) 628-5000 x442

July 1973

The environmental health engineering program at Tufts University provides students with both a theoretical and practical knowledge of environmental health engineering based on a sound foundation in biology, chemistry, and engineering. The program is of a multidisciplinary nature leading to the degree of MS. Course work is available within the Department of Civil Engineering with an emphasis in either water quality management, wastewater treatment and control, or public health. Supporting course work, depending on the student's interests and aptitudes, is available in the departments of biology, chemical engineering, chemistry, economics, geology, government, mathematics, physics, and sociology. The program integrates the various areas of environmental health engineering (domestic and industrial waste treatment, public health, experimental design, water quantity and quality, economics, water treatment) and develops the importance of each in relation to pollution and environmental effects.

Tufts is a small, privately supported university with a balanced emphasis on graduate and undergraduate education. At present the total enrollment is around 5,600 with about 800 in the graduate school of Arts and Sciences. Associated with the University is the National Council for Air and Stream Improvement. NCASI is an environmental service organization of the pulp and paper industry and has located at Tufts its Northeast Regional Research Center. A number of students are supported in cooperative research programs with this group. Tuition and fees for full-time graduate students are $3,200 for the academic year. Financial assistance in the form of research and teaching assistantships, traineeships, and tuition scholarships are available to qualified students.

Tufts University is distinctive in its long tradition of liberalism, in its location, and in the variety of its educational opportunities at the undergraduate level as well as in its graduate and professional schools. Founded in 1852 as a liberal arts college, Tufts has grown into a small modern university. The main campus is located on one of the highest hills in eastern Massachusetts, formerly known as Walnut Hill, in Medford and Somerville. This campus is five miles from the State House in the city of Boston and is conveniently accessible by public transportation. It covers about 150 acres and contains more than 100 buildings comprising the college community including professors' houses.

Admission Requirements

(a) 2.5/4 for MS.

(b) GRE scores are desirable but are not required.

(c) Minimum GPA can be waived under special circumstances.

(d) Foreign students must submit scores on TOEFL.

(e) In addition to the usual engineering disciplines, students with undergraduate degrees in chemistry, biology, biochemistry, mathematics, and physics will be considered for admission.

(f) Nonengineering students entering the program may be required to make up courses in mathematics, computer science, or introductory sanitary engineering.

(g) There are no fixed admission deadlines. However, early application is desirable; scholarships and assistantships are rarely available to late applicants. Assembly and appraisal of credentials is often subject to unavoidable delay after May 16.

Degree Requirements

Degree	Courses	Thesis	Language	Residence	Time (mo.)
MS--Envir. Health Engr.	9[a]	Optional	No	No	12-18

[a] A maximum of 2 courses may be used for thesis credit.

Course Work

Designation	Title	Instructor	Semester Courses	Pres.	Enrollment
CE 12	Water Resources Engineering	Colburn	1.0	S'73	57
CE 32	Water Supply & Sewage	Hanes	1.0	F'72	37
CE 131	Advanced Hydraulics	Dunkerley	1.0	W'73	13
CE 133	Sewage & Water Treatment	Hanes Brown	1.0	S'73	34
CE 134	Water & Wastewater Chemistry	Brown	1.0	F'72	12
CE 137	Public Health	Drummond	1.0	F'72	41
CE 151	Parasitology	Drummond	1.0	F'72	26
CE 152	Public Health Administration	Rubenstein	1.0	S'73	15
CE 154	Principles of Epidemiology	Drummond	1.0	S'73	24
CE 156	Mat. Inf. & Child Health	Hoffman	1.0	S'73	41
CE 194B	Human Nutrition	Vitale	0.5	S'73	15
CE 194A	Air Pollution	Gregory	1.0	S'73	8
CE 235	Industrial Wastes	Brown	1.0	S'73	13
CE 236	River & Lake Pollution	Hanes	1.0	S'72	10
CE 240	Advanced Wastewater Treatment	Brown	1.0	F'72	8
CE 291-2	Seminar	Staff	0.5	S'73	25
CE 294A	Experimental Design	Brown	1.0	S'73	6
CE 295-6	Thesis	Staff	V	S'73	12

BIO 101	Environmental Biology	Nickerson	1.0	F'72	100
BIO 142	Ecology	Maly	1.0	S'73	25
BIO 142	Oceanography	Hume Roys	1.0	S'73	75
BIO 151	Microbiology	Sweet	1.0	F'72	30
CHM 31	Physical Chemistry	Messer	1.0	F'72	60
CHM 53	Organic Chemistry	Staff	1.0	F'72	60
ES 101	Numerical Methods	Staff	1.0	F'72	30
MTH 161	Statistics	Huff	1.0	F'72	15

There are no specific course requirements, rather individual programs are designed for each student. The following guidelines are used: programs in water pollution control--CE 134, 137, 235, 236, and 240; programs in public health--CE 134, 137, 151, 152, and 154.

Faculty

LINFIELD C. BROWN
Assistant Professor
Department of Civil Engineering
1970

BSCE	Tufts University	Civil Engineering	1964
MS	Tufts University	Sanitary Engineering	1966
PhD	University of Wisconsin	Sanitary Engineering	1970

Wastewater treatment plant design and control, water and wastewater chemistry, experimental design, industrial wastes

100% (70% teaching, 20% research, 10% administration)

"A Least Cost Method for the Design of Wastewater Collection Systems," Journal Environmental Engineering Division, American Society of Civil Engineers, 99, EE3, June 1973 (with S. Walsh)

"Monte Carlo Simulation of Industrial Waste Discharges," Journal Sanitary Engineering Division, American Society of Civil Engineers, 95, SA5, October 1969 (with P. M. Berthouex)

"Comparative Studies of Dissolved Oxygen Analysis Methods," Journal Water Pollution Control Federation, 39, 8, August 1967 (with J. J. McKeown and G. W. Gove)

DAVID W. DRUMMOND
Assistant Professor
Department of Civil Engineering
1973

BS	California Institute of Technology	Plant Physiology	1962
MS	University of Minnesota	Environmental Health	1963
PhD	University of Minnesota	Environmental Health	1972

Bacteriology, biometry, public health, epidemiology

100% (70% teaching, 20% research, 10% administration)

"Citizen Action in Response to Perceived Hazards and Actual Environmental Hazards in an Inner City Area," American Journal of Public Health, March 1973 (with E. W. Mood)

"Dry Heat Destruction of Bacillus subtilis Spores on Surfaces, Effect of Humidity in an Open System," Applied Microbiology, 20, 1970 (with I. J. Pflug)

"Statistical Processing of Microbiological Data with the Digital Computer," presented at 9th Annual Technical Meeting of the American Association for Contamination Control, Anaheim, California, 1970 (with I. J. Pflug)

Previous full-time professional experience: 5 yrs. (research and development)

N. BRUCE HANES
Professor and Chairman
Department of Civil Engineering
1961

BS	North Dakota State University	Civil Engineering	1954
MS	University of Wisconsin	Sanitary Engineering	1957
PhD	University of Wisconsin	Sanitary Engineering	1961

Stream pollution and water bacteriology

75% (40% teaching, 10% research, 25% administration)

"Toxicity of Seawater to Coliform Bacteria," Journal Water Pollution Control Federation, 43, pp. 854-861, 1971 (with H. P. Savage)

"A Critical Examination of Bathing Water Quality Standards," Journal Water Pollution Control Federation, 43, pp. 2229-2241, 1971 (with D. H. Foster and S. M. Lord, Jr.)

"A Quantitative Analysis of the Effects of Bathers in Recreational Water Quality," Proceedings, 5th International Conference on Water Pollution Research, 1970 (with A. J. Fossa)

"New Technique for Measuring Oxygen Uptake Rates of Benthal Systems," Journal Water Pollution Control Federation, 40, pp. 223-232, 1968

Registered professional engineer: Massachusetts

Member, AEEP
Consultant, New England Consortium on Environmental Protection (1973)
Chairman, Aberjona River Commission (1973-date)
Consultant, National Science Foundation (1972-date)
Consultant, US Environmental Protection Agency (1965-date)
Member, Standard Methods Committee, Water Pollution Control Federation (1967-69)

NORTON H. NICKERSON
Associate Professor
Department of Biology

PhD	Washington University	-	1953

Ecology, environmental biology
25%

JAMES J. MCKEOWN
Regional Engineer, NCASI and
Lecturer, Department of Civil Engineering

MS	University of North Carolina	-	1960

Industrial wastes, stream pollution

RALPH E. WHEELER
Professor Emeritus
Department of Civil Engineering

MD	Harvard University	-	1926
DrPH	The Johns Hopkins University	-	1932

Epidemiology, microbiology

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Envir. Health Engr.	Master's	9	6	13	5	18	4	27	3	25	6	ENROLLMENT
Envir. Health Engr.	Master's	4		5		9		13		9		GRADUATES
Envir. Health Engr.	Master's	0		NON-US NATIONALS								

	Master's	
EPA traineeship	10	
PHS traineeship	4	
Teaching assistantship	2	SUPPORT
Tuition scholarship	3	
Self-supported	12	

Government	32.5
Consulting	20.0
Further study	32.5
Academic	2.5
Industry	7.5
Other	5.0

Facilities

The laboratory space maintained by the Department of Civil Engineering for environmental health engineering is well equipped for chemical, bacteriological, and radiological work. Space is provided, in addition to teaching laboratories, for bench-size and pilot-plant research. Tufts University also has a strong field program which requires special equipment. The University is served on the Medford campus by the University Library and the Edwin Ginn Library of the Fletcher School of Law and Diplomacy and on the Boston campus by the Medical-Dental Library. The Medford collection contains approximately 380,000 volumes and about 3,500 periodicals are received currently. In addition, the Lufkin Engineering Library (new in 1961) has about 13,000 volumes, 15,000 technical reports, and receives 400 periodicals currently. The Tufts Computation Center, a McIlroy Fluid Network Analyzer, and a shop are available to the students.

Utah State University

Logan, Utah

Division of Environmental Engineering
Department of Civil and Environmental Engineering
College of Engineering

1888

Environmental Engineering

ECPD Accredited--Civil and Environmental Engineering

Dr. E. J. Middlebrooks, Dean
College of Engineering
Engineering Building
Utah State University
Logan, UT 84322
(801) 752-4100 x7744

February 1974

The principal objective of the Division of Environmental Engineering is to train and educate graduate students concerning environmental problems and methods for their solution. The graduate program in environmental engineering is based upon the study of fundamental considerations and principles which are necessary for a rational approach to understanding the complex nature of environmental quality problems and their ultimate solution. In addition to the excellent complementary engineering offerings in water resources, hydrology, hydraulics, and irrigation, strong interdisciplinary emphasis is maintained in the fields of chemistry, microbiology, public health, ecology, natural resources, computer science, and economics. Degrees offered include the MS, CE, and PhD.

Utah State University was founded in 1888 as a part of the public educational system of the State of Utah. The University is a land-grant institution comprised of eight resident colleges with 54 departments, a School of Graduate Studies, University Extension, and research programs. A rich curriculum offers a wide range of good living and learning experiences where progress, growth, discovery, and enthusiasm all move in the same direction--toward the education of the student, his discovery of himself and his potential. With a student body of 9,000 Utah State has advantages of both large and smaller schools with such features as modern, new buildings, a spacious new library, excellent laboratories, and top-rated cultural attractions. These advantages are combined with close, personal attention to students and many opportunities to fraternize--only possible in smaller universities.

Utah State University is accredited by the Northwest Association of Secondary and Higher Schools and is on the accepted list of the Association of American Universities and of the American Association of University Women. It is a member of the American Council of Education and is listed by other accrediting agencies of specific fields.

Logan, home of Utah State University, is a town of 25,000 surrounded by mountains in the heart of Cache Valley, 80 miles north of Salt Lake City. The beauty of the campus and university setting is considered second to none.

Admission Requirements

(a) 2.8/4 for MS; 3.0/4 overall or on Master's work for PhD.

(b) Only the aptitude section of the GRE is required for admission to a graduate degree program.

(c) Admission to Master's program is possible for GPA less than 2.8/4 provided strong recommendations are submitted. Student is considered in nonmatriculated status until he demonstrates ability to achieve 3.0/4 overall work at graduate level.

(d) Foreign students must score a minimum of 600 on TOEFL.

(e) Any engineering discipline at an accredited institution is acceptable. Individuals with undergraduate degrees in chemistry or biology are also normally acceptable. Other disciplines are considered on an individual basis.

(f) Nonengineers are required to complete course work in mathematics through ordinary differential equations, fluid mechanics and applied hydraulics, hydrology, and engineering economics.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. Engr.	45Q	Optional	No	4Q	12
CE--Envir. Engr.	90Q	Yes	No	4Q	24
PhD--Envir. Engr.	90Q[a]	Yes	1	4Q	36

[a] Beyond MS.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CEE 360	Resource Util. & Envir. Management	Gearheart	3Q	A'72	34
CEE 364	Water & Wastewater Treatment	Jones	3Q	S'73	64
CEE 561	Water Quality Analysis	Porcella	3Q	A'72	22
CEE 562	Chemistry of Aquatic Systems	Jurinak	3Q	W'73	14
CEE 565	Design of Municipal Water Systems	Middlebrooks	3Q	W'73	16
CEE 566	Water Systems Analysis & Planning	Middlebrooks	3Q	S'73	14
CEE 664	Water & Wastewater Treatment	Staff	4Q	A'72	12
CEE 665	Water & Wastewater Treatment	Staff	4Q	W'73	11
CEE 666	Water & Wastewater Treatment	Staff	4Q	S'73	9
CEE 667	Industrial Wastewater Treatment	Staff	2Q	Su'73	7
CEE 761	Water Quality Management	Jones	3Q	A'72	28
CEE 762	Air Quality Management	Gearheart	3Q	W'73	13
CEE 763	Solid Waste Management	Jones	3Q	S'73	13
CEE 797	Dissertation Research	Staff	-	-	-
Ag&Irr 549	Water Law	Milligan	3Q	A'72	16
Ag&Irr 735	Irrigation Return Flow	Peterson	3Q	W'73	18
Chem 301	Physical Chemistry	Alger	4Q	A'72	41
Chem 370	Biochemistry	Farley	4Q	S'73	34

Bact 560	Aquatic Microbiology	Post	4Q	S'73	23
Bot 513	Fresh Water Algae	Lynn	4Q	S'73	16
LAEP 685	Environmental Planning Seminar	Smith	2Q	S'73	14
Soils 505	Chem. Soil-Water System	Jurinak	3Q	S'73	11
WS	Limnology	Koob	5Q	A'72	40

CEE 664, 665, 666, and 667 are required of all environmental engineering majors. (Lower CEE course numbers listed above are considered as a prerequisite, also Chem 301 and Bact 560.)

Faculty

ROBERT A. GEARHEART
Associate Professor
Division of Environmental Engineering
1971

BS	North Texas State University	Biology and Math	1964
MS	University of Oklahoma	Civil Engineering	1965
PhD	University of Oklahoma	Environmental Engineering	1969

Effects of pollutants on water quality, biological waste treatment, solid waste management, environmental management, operation of water and wastewater treatment plants

100% (50% extension, 25% teaching, 25% research)

"Agricultural Contribution to the Eutrophication Process in Beaver Reservoir," 1969 Winter Meeting American Society of Agricultural Engineers, Chicago, Illinois, December 1969

"Seasonal Variations in the Phyto-Plankton-Bacteria Populations and the Nutrient Concentration," 6th American Water Resources Conference, Las Vegas, Nevada, October 1970

"Some Effects of Sewage Effluent upon Phycoperiphyton in Lake Murray, Oklahoma," Proceedings Oklahoma Academy of Science, XLVI, pp. 19-29, 1965 (with H. E. Schlichting)

"Comprehensive Water Pollution Planning Study of the Upper White River," US Environmental Protection Agency, 1971-79, principal consultant

"Water Quality Characteristics of Beaver Reservoir," Bureau of Sports Fisheries, US Department of the Interior, 1968-71, principal investigator

"Comprehensive Solid Waste Management Plan for Cache County, Utah," Environment and Man Program Utah State University, 1973-75, co-principal investigator

Previous full-time professional experience: 8 yrs. (5 yrs. academic, 2 yrs. government, and 1 yr. research and development)

Member, AEEP
Engineer-Manager, Beaver Water District, Regional Water Supply in Northwest Arkansas (1968-70)
President, Association of Cleanwater Teachers and Instructors of Our Nation (ACTION) (1973)
Consultant, US Environmental Protection Agency, Graduate Fellowship and Training Grant Program (1969-date)

WILLIAM J. GRENNEY
Assistant Professor
Division of Electrical Engineering and Utah Water Research Laboratory
1972

BS	Michigan Technological University	Civil Engineering	1960
MS	Oregon State University	Civil Engineering	1969
PhD	Oregon State University	Environmental Civil Engineering	1972

Physical-chemical processes of wastewater treatment, mathematical modeling of ecological systems, systems analysis

100% (research)

"A Mathematical Model of the Nutrient Dynamics of Phytoplankton in a Nitrate Limited Environment," Biotechnology and Bioengineering, XV, pp. 225, 1973 (with D. A. Bella and H. C. Curl, Jr.)

"Field Study and Mathematical Model of the Slack Water Buildup of a Pollutant in an Estuary," Limnology and Oceanography, 17, p. 229, 1972 (with D. A. Bella)

"A Theoretical Approach to Interspecific Competition in Phytoplankton Communities," American Naturalist, 1973 (with D. A. Bella and H. C. Curl, Jr.)

"Finite--Difference Convection Errors," Journal Environmental Engineering Division, American Society of Civil Engineers, 96, p. 1361, 1970 (with D. A. Bella)

"Estimating Dispersion Coefficients in Estuaries," technical note, Journal Hydraulics Division, American Society of Civil Engineers, 89, p. 585, 1972 (with D. A. Bella)

Registered professional engineer: Oregon

Previous full-time professional experience: 9 yrs. (2 yrs. industry, 1 yr. consulting, 1 yr. academic, and 5 yrs. military)

Member, American Society of Civil Engineers

NORMAN B. JONES
Professor
Division of Environmental Engineering
1963

BS	Utah State University	Civil Engineering	1949
MS	University of California-Berkeley	Sanitary Engineering	1951

Solid waste management, water quality management, land disposal of liquid and solid wastes

100% (65% teaching, 20% research, 15% administration)

"Physical Limitations in Land Use Planning," Proceedings, Colloquium on Land Use Planning, Environment and Man Program, Utah State University, 1972

"Pollutional Characteristics of Irrigation Return Flow," Federal Water Pollution Control Administration (Contract 14-12-408), Robert S. Kerr Laboratory, Ada, Oklahoma, 1969 (contributor)

"Modifying Wastewater Treatment Plants to Meet New Standards," Public Works, 103, 8, pp. 80-84, 1972 (et al.)

"Graduate Training Grant in Water Quality," US Environmental Protection Agency, 7/68-6/73, program director

"Graduate Training Grant in Irrigation Return Flow," US Environmental Protection Agency, 7/69-6/74, associate program director

"Comprehensive Solid Waste Management Plan for Cache County, Utah," 1972-73, Environment and Man Program, Utah State University, co-principal investigator

Previous full-time professional experience: 12 yrs. (1 yr. research and 11 yrs. industry)

Charter Member, AEEP
Member, Utah Water Pollution Control Association; President (1971)
Member, American Water Works Association
Member, National Solid Waste Management Association

E. JOE MIDDLEBROOKS
Dean
College of Engineering
1970

BCE	University of Florida	Civil Engineering	1956
MSE	University of Florida	Sanitary Engineering	1960
PhD	Mississippi State University	Sanitary Engineering	1966

Biological kinetics, eutrophication assessment and control, wastewater treatment processes, manpower needs

100% (35% teaching, 50% research, 15% administration)

"Biostimulation and Algal Growth Kinetics of Wastewater," Journal Water Pollution Control Federation, 43, 3, pp. 454-473, 1971 (et al.)

"Professional Manpower Production," Journal Water Pollution Control Federation, 44, 7, pp. 1307-1316, 1972 (with R. G. Snider)

"Review Paper--The Effect of Carbon on Algal Growth: Its Relationship to Eutrophication," Water Research, 6, 6, pp. 637-679, 1972 (et al.)

"Modifying Wastewater Treatment Plants to Meet New Standards," Public Works, 103, 8, pp. 80-84, 1972 (et al.)

"Effects of Temperature on the Toxicity of Wastewater Discharges," Office of Water Resources Research, 7/71-6/73, principal investigator

"Separation of Algae Cells from Wastewater Lagoon Effluents," US Environmental Protection Agency, 6/73-4/75, principal investigator

Registered professional engineer: Arizona, Mississippi, and Utah

Previous full-time professional experience: 14 yrs. (2 yrs. government, 2 yrs. industry, 5 yrs. research and development, and 5 yrs. academic)

Member, AEEP
Diplomate, AAEE
President (1974), Association of Environmental Engineering Professors; Vice-President (1973); Board of Directors (1973-75); Chairman, Manpower Needs Committee (1970-date)
Consultant, US Environmental Protection Agency, Manpower Development Staff, Office of Water Programs (1970-date)

DONALD B. PORCELLA
Associate Professor
Division of Environmental Engineering and Utah Water Research Laboratory)
1970

AB	University of California-Berkeley	Zoology	1959
MA	University of California-Berkeley	Zoology	1961
PhD	University of California-Berkeley	Environmental Health Science	1967

Research on eutrophication, teaching environmental management and resource conservation, research on lake dynamics and limnology, research on toxicity and ecosystem analysis, teaching water chemistry and biology

100% (40% teaching, 60% research)

"Response to Tertiary Effluent in Indian Creek Reservoir," Journal Water Pollution Control Federation, 44, pp. 2148-2161, 1972 (with P. H. McGauhey and G. L. Dugan)

"Review Paper--The Effect of Carbon on Algal Growth: Its Relationship to Eutrophication," Water Research, 6, pp. 637-679, 1972 (et al.)

"Biostimulation and Algal Growth Kinetics of Waste Water," Journal Water Pollution Control Federation, 43, pp. 454-473, 1971 (et al.)

"Biological Effects on Sediment-Water Nutrient Interchange," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, pp. 911-926, 1970 (with J. S. Kumagai and E. J. Middlebrooks)

"Molting and Calcification in Daphnia Magna," Physiological Zoology, 42, pp. 148-159, 1969 (with C. E. Rixford and J. V. Slater)

"Phosphorus Management," US Environmental Protection Agency, FY 1973, principal investigator

"Mud-Water Nutrient Interactions," Office of Water Resources Research, FY 1973-74, principal investigator

"Temperature-Toxicity," Office of Water Resources Research, FY 1972-73, co-investigator

Previous full-time professional experience: 10 yrs. (3 yrs. academic, 5 yrs. research and development, and 2 yrs. government)

Member, American Water Works Association; Member, Subcommittee on Water Quality Control in Reservoirs (1969-date)
Member, Provisional Algal Assay Procedures Evaluation Committee, US Environmental Protection Agency (1969-date)
Member, Ad Hoc Committee for Registration of Environmental Laboratories in Utah, Utah State Public Health Department (1972-date)

HOWARD B. PETERSON
Professor
Department of Agricultural and Irrigation Engineering
PhD University of Nebraska Soil Chemistry 1949
Irrigation return flow and soil-water-plant relations
50%

ROBERT W. HILL
Assistant Professor
Department of Civil and Environmental Engineering
PhD Utah State University Water Resources 1972
Water resources systems modeling, planning, and management
50%

JEROME J. JURINAK
Professor
Department of Soil Science
PhD Utah State University Soil Chemistry 1956
Chemistry and physics of soil-water systems
60%

A. BRUCE BISHOP
Assistant Professor
Department of Civil and Environmental Engineering
PhD Stanford University Engineering Economic Planning 1970
Environmental aspects of regional planning, systems analysis, and economics
60%

JOHN PAUL RILEY
Professor
Department of Civil and Environmental Engineering
PhD Utah State University Water Resources 1967
Computer simulation of water resource systems
50%

RAY LYNN
Associate Professor
Department of Botany
PhD University of Indiana Microbial Ecology 1968
Physiology and ecology of fresh water algae
50%

FREDERICK J. POST
Associate Professor
Department of Biology
PhD Michigan State University Microbiology 1958
Aquatic microbiology
25%

JACK KELLER
Professor
Department of Agricultural and Irrigation Engineering
PhD Utah State University Irrigation Engineering 1967
Sprinkler irrigation and drainage design
30%

JOHN M. NEUHOLD
Professor and Director Ecology Center
Department of Wildlife Science
PhD Utah State University Aquatic Ecology 1959
Aquatic ecology and ecological systems modeling
50%

GARY Z. WATTERS
Associate Professor
Department of Civil and Environmental Engineering
PhD Stanford University Hydraulics 1963
Applied hydraulics of water conveyance systems and wastewater stabilization ponds
30%

J. CLAIR BATTY
Associate Professor
Department of Mechanical Engineering
PhD Massachusetts Institute of Technology Mechanical Engineering 1969
Resource recovery and energy utilization
25%

GLEN H. SMERAGE
Assistant Professor
PhD Stanford University Electrical Engineering 1967
Systems analysis of environmental systems
25%

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental	Master's	9	0	7	0	8	0	7	0	6	2	ENROLLMENT
Engineering	Doctoral	1	0	2	0	2	0	2	0	1	0	

		69-70	70-71	71-72	72-73	73-74	
Environmental	Master's	8	7	7	5	7	GRADUATES
Engineering	Doctoral	0	1	2	2	1	

Environmental	Master's	3	NON-US NATIONALS
Engineering	Doctoral	2	

	Master's	Doctoral	
EPA traineeship	6	0	SUPPORT
EPA doctoral fellowship	0	2	
Research assistantship	5	2	
Self-supported	1	1	

	Master's	Doctoral	
Consulting	48	40	EMPLOYMENT (%)
R & D	4	0	
Industry	4	0	
Federal government	16	20	
Other government	12	0	
Academic	0	40	
Further study	12	0	
Military	4	0	

Facilities

Basic teaching facilities located in the Engineering Building include 3000 square feet of unit operations and water chemistry laboratories. Outstanding supporting facilities, equipment, and staff are located in the spacious (80,000 square feet) and nearby Utah Water Research Laboratory which is administered as part of the College of Engineering. Many student research investigations are carried out at this facility.

Vanderbilt University

Nashville, Tennessee

Environmental and Water Resources Engineering Program
School of Engineering

Environmental and Water Resources Engineering

ECPD Accredited--Environmental Engineering

Dr. Barry A. Benedict, Program Director
Environmental and Water Resources Engineering Program
Box 57, Station B
Vanderbilt University
Nashville, TN 37235
(615) 322-2697

December 1973

The orientation of the environmental and water resources engineering graduate program at Vanderbilt University is toward the education of students to enable them to enter professional practice in environmental engineering and sciences. The student can specialize to some extent in the following areas in the program: water and wastewater treatment, water resources, air pollution control, solid waste management, and environmental sciences. The following degrees are offered in the environmental and water resources engineering program: MS and PhD.

The University is a private university with an enrollment of about 6,500 students, of which approximately 1,000 are graduate students. Cooperative teaching arrangements exist between our program, physics, and radiology, enabling students to prepare for careers in radiation safety. A strong College of Medicine provides supporting work in preventive medicine and public health. Vanderbilt is the home of the Urban and Regional Development Center, providing a focus for attacking problems of the urban environment. The University is located in the heart of the Tennessee Valley Authority system, and cooperative efforts between TVA and Vanderbilt personnel and students have been numerous through the years. Tuition and fees for full-time graduate students average $2,600 for an academic year.

Vanderbilt University is located in middle Tennessee at Nashville, a city of close to one-half million. This urban community is surrounded by a host of water-related and other recreational facilities, offering exceptional opportunities both for field studies and recreation.

Admission Requirements

(a) 3.0/4 GPA for admission.

(b) GRE is not required; however, it can be used as an added justification where the GPA is below 3.0/4.

(c) Admission is possible with lower GPA if additional supporting evidence can be provided. Such evidence may include any or all of high GRE scores, experience in responsible positions, and strong recommendations.

(d) Foreign students must score a minimum of 500 on TOEFL.

(e) Any engineering discipline at an accredited institution is acceptable. Students from non-engineering backgrounds are generally also acceptable, although they will have varying degrees of make-up work to do.

(f) All students are generally expected to have competence in fluid mechanics, basic chemistry, and mathematics through ordinary differential equations. If they have not acquired this knowledge previously, appropriate courses will be included in their program.

(g) The University requires three letters of recommendation.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Envir. & Water Res. Engr.	24-30S[a]	Optional	No	2S	12
PhD	48S	Yes	No	2S	12

[a] With thesis option, 24S are required; with nonthesis, 30S.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
EWRE 150	Man & His Environment	Krenkel	-	S'73	66
EWRE 151	Special Topics on Man & His Envir.	Benedict	-	New'72	-
EWRE 200	Individual Study	Staff	-	S'73	3
EWRE 210	Basic Water Resources Engineering	Staff	-	S'73	33
EWRE 211	Water & Wastewater Treatment	Thackston	-	F'72	22
EWRE 220	Environmental Problems	Staff	-	S'73	10
EWRE 221	Envir. Problems: Solid Wastes & Radiological Health	Staff	-	New'72	-
EWRE 222	Methods of Scientific Research	Malaney	-	New'73	-
EWRE 246	Solid Waste Collection Practice	Rowe	-	New'72	-
EWRE 247	Municipal Refuse Disposal Practice	Rowe	-	New'72	-
EWRE 250	Principles of Water Treatment & Wastewater Disposal	Staff	-	F'72	1
EWRE 270	Public Health Engineering	Malaney	-	S'73	24
EWRE 272	Microbiology of Water, Wastewater & Air	Malaney	-	S'73	17

EWRE 273	Environmental Chemistry Lab.	Malaney	-	F'72	19
EWRE 277	Open Channel Hydraulics	Benedict	-	F'72	5
EWRE 278	Hydrology	Rowe	-	F'72	12
EWRE 279	Economics & Law of Water & Air Re	Parker	-	F'72	31
EWRE 280	Atmospheric Pollution	Schnelle	-	F'72	24
EWRE 281	Sampling & Analysis of Polluted Atmospheres	Schnelle	-	F'71	5
EWRE 290	Special Topics in EWRE	Staff	-	S'73	1
EWRE 295	Solid Waste Management	Rowe	-	S'73	10
EWRE 300	Water Quality Management	Krenkel	-	S'73	15
EWRE 318	Systems Analysis for Envir. Engineers	Schnelle	-	F'72	8
EWRE 319	Instrumentation for Envir. Engineers	Schnelle	-	S'73	1
EWRE 321	Water Treatment Theory & Practice	Thackston	-	F'72	18
EWRE 322	Waste Treatment Theory & Practice	Eckenfelder	-	F'72	7
EWRE 323	Industrial Waste Treatment	Eckenfelder	-	S'73	14
EWRE 324	Advanced Envir. Engineering	Thackston	-	S'73	4
EWRE 325	Individual Study	Staff	-	S'73	1
EWRE 327	Epidemiology	Quinn	-	S'73	4
EWRE 328	Public Health & Preventive Medicine	Quinn	-	S'73	5
EWRE 330	Radiological Aspects of Envir. Engr.	Parker	-	S'73	6
EWRE 331	Bio. & Biochem. of Polluted Envir.	Malaney	-	S'73	7
EWRE 332	Advanced Air Resources Engr.	Schnelle	-	F'72	1
EWRE 333	Air Pollution Control	Schnelle	-	S'72	8
EWRE 334	Air Pollution Meteorology	Schnelle	-	S'72	8
EWRE 341	River & Harbor Engineering	Benedict	-	S'73	5
EWRE 345	Water Resources Engineering	Parker	-	S'73	1
EWRE 346	Ground Water Hydrology	Benedict	-	S'73	4
EWRE 351	Adv. Industrial Waste Treat. Design	Eckenfelder	-	S'73	7
EWRE 369	Master's Thesis Research	Staff	-	S'73	2
EWRE 399	PhD Dissertation Research	Staff	-	S'73	7
Chem 220a	Organic Chemistry	Varies	-	S'73	100+
ChemE 230	Transport Phenomena	Overholser	-	F'72	10
Math 252	Statistics for Envir. Engr.	Williams	-	Su'72	2

Faculty

BARRY A. BENEDICT
Associate Professor and Program Director
Environmental and Water Resources Engineering
1969

BE	University of Florida	Civil Engineering	1965
MS	University of Florida	Engineering	1967
PhD	University of Florida	Civil Engineering	1968

Fluid flows in the environment, thermal pollution, diffusion and dispersion, sediment transport

100% (40% teaching, 30% research, 30% administration)

Analytical Modeling of Thermal Discharges: A Review of the State of the Art, to be published by the Atomic Energy Commission (with J. L. Anderson and E. L. Yandell, Jr.)

"Heated Surface Jet Discharged into a Flowing Ambient Stream," Water Pollution Control Research Series, Report No. 16130 FDQ 03/71 (with L. H. Motz)

"Surface Jet Model for Heated Discharges," Journal Hydraulics Division, American Society of Civil Engineers, 98, HY1, 1972 (with L. H. Motz)

"Hydrodynamic Lift on a Stream Bed," Chapter 5 in Sedimentation, 1972 (with B. A. Christensen)

"National Center for Research and Training in the Hydraulic and Hydrologic Aspects of Water Pollution Control," US Environmental Protection Agency, 1968-71, February 1973-date, deputy to principal investigator

Previous full-time professional experience: 2 yrs.

Member, Water Resources Engineering Education Committee of Universities Council on Water Resources
Reviewer, American Society of Civil Engineers

W. WESLEY ECKENFELDER, JR.
Distinguished Professor
Environmental and Water Resources Engineering
1970

BCE	Manhattan College	-	1946
MS	Pennsylvania State University	Sanitary Engineering	1948
MCE	New York University	Sanitary Engineering	1954

Wastewater treatment

100% (70% teaching, 30% research)

Industrial Water Pollution Control, 1966

Water Pollution Control, 1971 (with D. L. Ford)

Water Quality Engineering for the Practicing Engineer, 1970

Process Design in Water Quality Engineering, 1973 (with E. L. Thackston)

"Cost Effectiveness of Aeration Equipment," Ferro Corporation

"An Evaluation of Household Sewage Disposal Systems," Whirlpool Corporation

"Galveston Bay Project," Federal Water Pollution Control Administration, The University of Texas at Austin

Registered professional engineer: Texas

Previous full-time professional experience: 16 yrs. (academic)

Member, Effluent Standards and Water Quality Information Advisory Committee, US Environmental Protection Agency (1973)
Member, International Association for Water Pollution Research; Member, Executive Committee (1970-72)
Technical Program Coordinator at 5th International Conference on Water Pollution Research, San Francisco, California (1970)

GEORGE W. MALANEY
Professor
Environmental & Water Resources Engineering
1962

BA	Ohio State University	Bacteriology	1948
PhD	Ohio State University	Bacteriology	1953

Microbiology and biochemistry in the environment, microbiology in waste treatment processes, improvement of public understanding of science

100% (90% teaching, 10% research)

"Dual Substrate Utilization by Activated Sludge Microflora," Water and Sewage Works, 1971 (with J. A. Carter)

"Structural Determinants in the Oxidation of Aliphatic Compounds by Activated Sludge, Part 2," Journal Water Pollution Control Federation, 1969 (with R. M. Gerhold)

"Evaluation of Methods for Enumeration of Enterococci in Farm Pond Waters," Water and Sewage Works, 1969 (with S. G. Robinson and H. H. Weiser)

"Presence of Acetylcholinesterase-Inhibiting Compounds in Nashville Air," Vanderbilt University, 1973

Previous full-time professional experience: 4 years

FRANK L. PARKER
Professor
Environmental and Water Resources Engineering
1967

Economics and law of pollution control, thermal pollution, radioactive waste disposal

67% (40% teaching, 27% research)

"Thermal Pollution: Status of the Art," Report No. 3, 1969 (with P. A. Krenkel)

Engineering Aspects of Thermal Pollution, 1969 (with P. A. Krenkel)

"Status of Radioactive Waste Disposal in USA," Journal Sanitary Engineering, American Society of Civil Engineers, 95, 3, June 1969

"Radioactive Wastes from Fusion Reactors," Science Magazine, 159, 3810, January 1968

"National Center for Research and Training in the Hydraulic and Hydrologic Aspects of Water Pollution Control," US Environmental Protection Agency, 1968-71, February 1973-date, principal investigator

"Water Quality Index," Oak Ridge National Laboratory, 1973, principal investigator

"Corps of Engineers Recreational Evaluations," Corps of Engineers, principal investigator

Registered professional engineer: New York

Previous full-time professional experience: 20 yrs.

Representative of the World Health Organization (with Dr. E. Shalmon) to the International Atomic Energy Agency's panel of experts on Thermal Discharges from Nuclear Power Plants and Their Impact on the Environment (1972)
Advisor to the Governor of Tennessee on the Environmental Effects of Liquid Metal Fast Breeder Reactor
Member, American Society of Civil Engineers; Member, Committee on Sanitary Aspects of Nuclear Energy
Permanent Reviewer for Nuclear Safety Journal on Movement of Radionuclides in Surface Waters

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JOHN A. ROTH
Professor
Chemical Engineering and Environmental Engineering
1962

BE	University of Louisville	Chemical Engineering	1956
MS	University of Louisville	Chemical Engineering	1957
PhD	University of Louisville	Chemical Engineering	1961

Advanced waste treatment, economics of waste treatment processes

25% (15% teaching, 10% research)

"Dynamic Models for Laboratory Scale Complete Mixing Activated Sludge Waste Treatment Plants," accepted for publication and presentation, June 1974 (with M. Reed and W. W. Eckenfelder)

"A Technical Rationale for the Development of Industrial Effluent Guidelines," November 1973 (with W. W. Eckenfelder and A. W. Edwards)

"Dynamic Simulation of Gas Chromatographic Columns," 1967 (with C. L. Lai)

Registered professional engineer: Tennessee

ROBERT S. ROWE
Professor
Environmental and Water Resources Engineering and Civil Engineering
1960

MS	Columbia University	Civil Engineering	1949
MEng	Yale University	Civil Engineering	1950
PhD	Yale University	Civil Engineering	1951

Solid waste management, leachate studies, hydrology

75% (65% teaching, 10% research)

Bibliography of Rivers and Harbors and Related Fields in Hydraulic Engineering

French-English Translation Guide for River and Harbor Engineering

German-English Translation Guide for River and Harbor Engineering

Russian-English Translation Guide for River and Harbor Engineering

"SORTER Project" (to devise means of metal separation for recycling purposes), US Environmental Protection Agency, 1972, consultant to project on recycling aspects

Registered professional engineer: Maryland, New Jersey, North Carolina, and Tennessee

Previous full-time professional experience: 5 yrs.

Member and Past Chairman, Black Colleges Development Committee, American Society for Engineering Education, American Society of Civil Engineers
Member, National Society of Professional Engineers; Member, Accrediation Committee
Member, American Concrete Institute; Member, Plain Concrete Committee

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KARL B. SCHNELLE, JR.
Professor
Environmental and Water Resources Engineering
1958

BS	Carnegie-Mellon University	Chemical Engineering	1952
MS	Carnegie-Mellon University	Chemical Engineering	1957
PhD	Carnegie-Mellon University	Chemical Engineering	1959

Air pollution control, instrumentation for air and water quality monitoring, dynamic testing of monitoring instruments

50% (40% teaching, 10% research)

Introduction to Air Pollution Control, 2nd ed., 1970 (with B. B. Crocker)

"Transient and Frequency Response of Air Quality Monitors," Journal Air Pollution Control Association, 22, 7, 1972 (with R. D. Neeley)

"Air Pollution Analyzer Dynamics," Instrumentation Technology, 19, 6, 1972 (with R. D. Neeley)

"Storage and Evaluation of Data from Environmental Quality Monitoring Systems," 1971

"Evaluation of a Summer Institute to Train Instructors of Instrumentation Technology," Office of Education, US Department of Health, Education and Welfare, project director

"Dewatering and Drying of Sewage Sludge on Porous Media," Federal Water Pollution Control Administration, principal investigator

"A Study of the Vertical Distribution of Carbon Monoxide and Temperature above the Intersection of 8th Avenue and Broadway," Metropolitan Nashville and Davidson County Board of Health, principal investigator

Registered professional engineer: Tennessee

Previous full-time professional experience: 5 yrs.

Member, Instrument Society of America; Past President and Founder of Nashville Section

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EDWARD L. THACKSTON
Associate Professor
Environmental and Water Resources Engineering
1965

BE	Vanderbilt University	Civil Engineering	1961
MS	University of Illinois	Sanitary Engineering	1963
PhD	Vanderbilt University	Sanitary & Water Resources Engr.	1966

Economic, legal, and political aspects of pollution control; water and wastewater treatment; water quality management

100% (80% teaching, 20% research)

Process Design in Water Quality Engineering, New Concepts and Developments, 1972 (with W. E. Eckenfelder)

Energy in Tennessee, 1973 (et al.)

"Secondary Waste Treatment for a Small Diversified Tannery," Report EPA-R2-73-209, 1973

"Rate of Warming of Hydroelectric Plant Discharges," US Environmental Protection Agency through the National Center for Research and Training in Hydrologic and Hydraulic Aspects of Pollution Control, 1970-72, principal investigator

"Effect of Geographical Location on Cooling Ponds," US Environmental Protection Agency through the National Center for Research and Training in Hydrologic and Hydraulic Aspects of Pollution Control, 1969-71, principal investigator

"Turbulent Diffusion and Reaeration in Natural Rivers," Federal Water Pollution Control Administration, 1967-70, co-investigator and principal investigator

Registered professional engineer: Tennessee

Previous full-time professional experience: 3 yrs.

Member, AEEP
Advisor to Governor of Tennessee on Environmental Matters (1971-date)
Chairman, Water Pollution Committee, Tennessee Environmental Council (1970-71)
Member, Newsletter Committee, Association of Environmental Engineering Professors (1969-date)

ROBERT W. QUINN
Professor
Environmental and Water Resources Engineering and Preventive Medicine
1952

MD, CM	McGill University	Medical School	1938

Public health, preventive medicine, epidemiology

5% (teaching)

"The Epidemiology of Intestinal Parasites of Importance in the United States," Southern Medical Bulletin, 59, 5, October 1971

"The Utilization of Medical Services by a Family Clinic Population," Journal Tennessee Medical Association, 62, 2, 1969

"Epidemiology of Gonorrhea," Southern Medical Bulletin, 59, 2, April 1971

Previous full-time professional experience: 6 yrs.

Licensed to practice medicine in California, Connecticut, Wisconsin, and Tennessee

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HAROLD E. HODGES
Adjunct Associate Professor
Environmental and Air Resources Engineering
MS University of Minnesota Public Health (Environmental) 1966

S. LEARY JONES
Adjunct Associate Professor
Environmental and Water Resources Engineering
MPH The Johns Hopkins University Public Health 1942
Diplomate, AAEE

LILIA ABRON
Adjunct Assistant Professor
Environmental and Water Resources Engineering
PhD University of Iowa Chemical Engineering 1972

CARL E. ADAMS, JR.
Adjunct Assistant Professor
Environmental and Water Resources Engineering
PhD University of Texas Environmental Health Engineering 1969

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Envir. & Water	Master's	17		11		12		16		21		ENROLLMENT
Resources Engr.	Doctoral	10		12		11		10		8		
Envir. & Water	Master's	14		8		10		7		13		GRADUATES
Resources Engr.	Doctoral	3		3		4		3		2		
Envir. & Water	Master's	0		NON-US NATIONALS								
Resources Engr.	Doctoral	5										

	Master's & Doctoral	
Institutional fellowships	5	SUPPORT
Industrial fellowships	1	
Other fellowships	3	
EPA traineeships	6	
Self-supporting	4	
Consulting	25	EMPLOYMENT (%)
Industry	10	
Federal government	20	
Other government	25	
Academic	5	
Further study	5	
Outside environmental area	5	
Unknown	5	

Virginia Polytechnic Institute and State University

Blacksburg, Virginia

Civil Engineering Department
College of Engineering

Sanitary Engineering
Civil Engineering
Environmental Sciences and Engineering

ECPD Accredited--MS in Sanitary Engineering

Dr. Paul H. King
Professor of Sanitary Engineering
Civil Engineering Department
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061
(703) 951-6131

May 1973

Graduate work at Virginia Tech in the environmental engineering area emphasizes water supply and water pollution control, water resources planning, and air quality management. Courses are also available in solid waste management and radiological health. Students enrolling in the MS program having undergraduate dgrees in chemical or civil engineering normally work toward the MS in sanitary engineering and the PhD in civil engineering (major in sanitary). Students with a background in biology, chemistry, statistics, geology or other related nonengineering disciplines may earn the MS or PhD in environmental sciences and engineering.

Virginia Tech is the land-grant institution of the State and has a current enrollment of about 15,000. The graduate enrollment is about 2,000. The environmental engineering program maintains strong interdisciplinary ties with major research programs in aquatic biology and water pollution statistics and benefits from the presence on campus of the Virginia Water Resources Research Center. Tuition and fees for full-time graduate students average $700 for an academic year.

Blacksburg is a town of approximately 25,000 population, including students, and is located on a plateau in the Allegheny-Blue Ridge Mountains in the southwestern portion of Virginia. Blacksburg is 40 miles west of Roanoke, Virginia.

Admission Requirements

(a) 2.7/4 for MS; 3.2/4 on MS work for PhD.

(b) GRE is not required but scores should be submitted if available.

(c) Provisional admission available for GPA down to about 2.4/4 if strong recommendations are submitted.

(d) TOEFL test required for international students from non-English speaking countries.

(e) Acceptable undergraduate disciplines include all engineering, biology, chemistry, geology, statistics, agricultural sciences, and operations research.

(f) There are no stated prerequisites for nonengineers although deficiencies in mathematics and chemistry must frequently be removed.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Sanitary Engineering	35Q	Yes	No	2Q	11
MS--Envir. Sci. & Engr.	35Q	Yes	No	2Q	11
PhD--Civil Engineering	70Q	Yes	a	3Q	36
PhD--Envir. Sci. & Engr.	70Q	Yes	a	3Q	36

[a] One language or 6S humanities.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 408	Sanitary Engineering Principles	King	3Q	S'73	25
CE 4026	Intro. to Air Pollution	Stephens	3Q	S'73	75
CE 434	Sanitary Engineering	King Randall	3Q	S'73	30
CE 5010	Advanced Sanitary Engr. Principles	Harms Hoehn	3Q	A'72	28
CE 5011	Industrial Waste Treatment	Harms Randall	3Q	S'73	20
CE 5012	Stream Sanitation	Hoehn	3Q	W'73	35
CE 5017	Bio-Engineering	Jennelle	3Q	S'72	10
CE 5021	Sanitary Engineering Lab.	Harms Hoehn	2Q	W'73	30
CE 5023	Water Quality & Water Treatment	Harms Hoehn	3Q	S'73	8
CE 512	Sanitary Engineering Design	Randall	3Q	A'72	25
CE 522	Sanitary Engineering Design	Jennelle	3Q	W'73	22
CE 532	Sanitary Engineering Design	King	3Q	S'73	22
CE 513	Public Health Engineering	Jennelle	3Q	A'72	12
CE 523	Public Health Engineering	Randall	3Q	W'73	10
CE 533	Public Health Engineering	Jennelle	3Q	S'73	15

CE 515-525-535	Seminar	-	1Q	S'73	30
CE 519	Atmospheric Pollution Fundamentals	Stephens	4Q	A'72	18
CE 529	Atmospheric Pollution Effects & Measures	Stephens	4Q	W'73	12
CE 539	Atmospheric Pollution Control	Stephens	3Q	S'73	10
ChemEng 508	Advanced Separations Processes	Michelsen	3Q	S'73	5
Chem 5162, 5262, 5362	Colloid & Surface Chemistry	Wightman	2Q	S'72	10
Biol 503	Environmental Science: Water	Cairns	2Q	S'73	20
Biol 513, 523	Limnology	Simmons	4Q	S'73	15
Microbiol 408	Aquatic Microbiology	Benoit	3Q	A'72	25
Statistics 598	Stochastic Modeling in Water Poll.	Krutchkoff	3Q	S'73	25

Required courses for MS in sanitary engineering include CE 408, 5010, 512, 522, 532, 5012, and 5021. For the MS in environmental sciences and engineering, CE 408, 5010, 5012, and 5021 are required.

Faculty

CLIFFORD W. RANDALL
Professor
Civil Engineering Department
1966

BS	University of Kentucky	Civil Engineering	1959
MS	University of Kentucky	Sanitary Engineering	1962
PhD	University of Texas	Environmental Engineering	1966

Biological waste treatment, sanitary, microbiology, radiological health

100% (70% teaching, 30% research)

"Activated Sludge Dewatering: Factors Affecting Drainability," Journal Water Pollution Control Federation, 43, pp. 102-122, 1971

"Microbial Process for Acidic Low Nitrogen Wastes," Journal Water Pollution Control Federation, 44, pp. 401-413, 1972

"Factors Affecting Color Development during the Treatment of TNT Waste," Proceedings, 27th Purdue Industrial Waste Conference, 1972 (in press)

"Butane Freezing for Activated Sludge Dewatering," Office of Water Resources Research, 7/1/72-6/30/73, co-principal investigator

"Microbial Release of Soluble Phosphate in an Activated Sludge Environment," Office of Water Resources Research, 7/68-6/70, principal investigator

"Occoquan Watershed Water Quality Monitoring Program," Virginia State Water Control Board, 7/72-indefinite, project director

Previous full-time professional experience: 8 yrs. (academic)

Member, AEEP
Member, Water Pollution Control Federation; Member, Standard Methods Committee (1966-date); Vice-Chairman, Program Committee (1971-72); Chairman, Program Committee (1972-73)
Member, American Society of Civil Engineers; Member, Subcommittee on Study of High Rate Treatment Practices (1972-date)
Consultant to several industries

PAUL H. KING
Professor
Civil Engineering Department
1966

BS	California Institute of Technology	Civil Engineering	1957
MS	California Institute of Technology	Civil Engineering	1961
PhD	Stanford University	Civil Engineering	1966

Water treatment, water resources planning, chemical treatment of wastes

100% (60% teaching, 40% research)

"Polyelectrolyte Conditioning of Alum Sludges," Journal American Water Works Association, 62, 792, 1970 (with H. M. Bugg and C. W. Randall)

"Effect of Reservoir Operating Policy on Recreation Benefits," Water Resources Bulletin, Journal American Water Resources Association, 7, 765, 1971 (with J. M. Morgan)

"Conditioning and Disposal of Ferric Sulfate Sludges," in Recent Developments in Industrial Pollution Control, Technomic Publishing Company, Westport, Connecticut, 1971 (et al.)

"Coagulant Recovery and Reuse in Water Reclamation Systems," Office of Water Resources Research, 7/71-6/73, principal investigator

"Economic Disposal of Water Treatment Plant Sludge," Office of Water Resources Research, principal investigator

"Pesticide Distribution in Algae Laden Environment," National Science Foundation, principal investigator

Registered professional engineer: Kentucky

Previous full-time professional experience: 5 yrs. (2 yrs. government, 1 yr. consulting, and 2 yrs. academic)

Member, AEEP
Member, American Society of Civil Engineers; Member, Water Purification Committee (1971-date)
Member, Water Pollution Control Federation; Member, Standard Methods Committee (1971-date)
Consultant to several industries

ERNEST M. JENNELLE
Associate Professor
Civil Engineering Department
1955

BS	Virginia Polytechnic Institute	Civil Engineering	1955
MS	Virginia Polytechnic Institute	Sanitary Engineering	1956
PhD	Oklahoma State University	Engineering	1969

Environmental engineering, biological waste treatment

100% (70% teaching, 30% research)

"Studies on the Kinetics and Mechanism of Deoxygenation in Open and Closed Systems," Biotechnology and Bioengineering, 12, 519, 1970 (with A. F. Gaudy)

"Goals in Wastewater Treatment," Water Resources Bulletin, Journal American Water Resources Association, 8, 1972 (with M. K. Jones)

"Will Wastewater Treatment Stop Eutrophication of Impoundments?," presented at 27th Annual Purdue Industrial Waste Conference, May 1972 (with T. J. Grizzard)

"Investigation of Water Quality in the Roanoke River Basin," Virginia Division of Water Resources, 8/72-12/73, principal investigator

Registered professional engineer: Virginia

Previous full-time professional experience: 18 yrs. 3 mos. (15 mos. industry and 17 yrs. academic)

Diplomate, AAEE
Consultant to several engineering firms

ROBERT C. HOEHN
Assistant Professor
Civil Engineering Department
1971

BS	North Texas State University	Science Education	1955
MA	North Texas State University	Biology	1966
PhD	University of Missouri	Environmental Sciences	1970

Biological and chemical aspects of water quality

100% (75% teaching, 25% research)

"Treatment of a Munitions-Manufacturing Waste by the Fixed Activated Sludge Process," Proceedings, 27th Annual Purdue Industrial Waste Conference, May 1972, in press (with R. C. Albert and C. W. Randall)

"The Effects of Thickness on Bacterial Films," Journal Water Pollution Control Federation, 1972, in press (with A. D. Ray)

"The Treatability of a Munitions-Manufacturing Waste with Activated Carbon," presented at 28th Annual Purdue Industrial Waste Conference, May 1973 (with G. R. Schulte)

"Modeling of Antarctic Freshwater and Terrestrial Ecosystems," National Science Foundation, 1972-77, co-principal investigator

Previous full-time professional experience: 6 yrs. (5 yrs. academic and 1 yr. teaching)

Member, Virginia Water Pollution Control Federation; Member, Student Relations Committee (1972-date)
Consultant to several industries

N. THOMAS STEPHENS
Associate Professor
Civil Engineering Department
1970

BS	University of New Mexico	Biology	1955
BS	New Mexico State University	Chemical Engineering	1961
MS	University of Florida	Environmental Engineering	1967
PhD	University of Florida	Environmental Engineering	1969

Air pollution control processes, atmospheric chemistry, wastewater treatment, environmental health

100% (44% teaching, 6% research, 50% extension)

"Atmospheric Aerosols," Science, 166, 381, October 1969 (with R. O. McCaldin and L. W. Johnson)

"Attenuation of Power Station Plumes as Determined by Instrumented Aircraft," Environmental Science and Technology, 5, 615, July 1971 (with R. O. McCaldin)

"Field Sampling Techniques for Airbourne Pollutants," Proceedings, 2nd Annual Environmental Engineering Conference, University of Louisville, April 1972 (with L. W. Johnson)

"Butane Freezing for Activated Sludge Dewatering," Office of Water Resources Research, 7/1/72-6/30/73, co-principal investigator

"A Proposal for Studying Particulate Emission Levels on the Premises of Roanoke Electric Steel Plant, Roanoke, Virginia," Roanoke Electric Steel Corporation, 8/71-6/73, project leader

"The Occurrence and Fate of Trace Elements in Coal Combustion Processes," Southern Services, Inc., 6/72-6/73, project leader

Previous full-time professional experience: 10 yrs. (3 yrs. academic and 7 yrs. industry)

Member, Air Pollution Control Association (1966-date)
Associate Member, American Institute of Chemical Engineers (1962-date)
Member, Technical Advisory Committee, Virginia Air Pollution Control Board (1973-date)
Member of Board of Directors, Mid-Atlantic Consortium on Air Pollution (197[illegible]-date)

IVON H. LOWSLEY, JR.
Assistant Professor
Civil Engineering Department
1970

BS	US Naval Academy	-	-
MS	University of Oklahoma	Civil Engineering	1966
PhD	The Johns Hopkins University	Environmental Engineering	1973

General sanitary engineering, water resources, systems analysis techniques

100% (teaching)

Previous full-time professional experience: 3 yrs. (academic)

Faculty Advisor, VPI & SU Student Chapter of the American Society of Civil Engineers

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LELAND L. HARMS
Assistant Professor
Civil Engineering Department
1973

BS	South Dakota School of Mines	Civil Engineering	1962
MS	South Dakota School of Mines	Civil Engineering	1968
PhD	South Dakota State University	Civil Engineering	1973

Water supply and wastewater treatment, nonpoint source pollution

100% (75% teaching, 25% research)

"Sodium Absorption Ratio Influence on Stabilization Pond Sealing," Journal Water Pollution Control Federation, 41, R383, 1969

"Graphical Measurement of Triangular Weir Discharge," Water and Wastes Engineering, 7, E-8, 1970

Previous full-time professional experience: 7 yrs. (4 yrs. academic and 3 yrs. industry)

RICHARD G. KRUTCHKOFF
Professor
Statistics Department

PhD	Columbia University	Physics and Statistics	1964

Environmental statistics
50%

JOHN CAIRNS, JR.
Professor
Biology Department

PhD	University of Pennsylvania	Zoology	1953

Aquatic biology
100%

ROBERT E. BENOIT
Associate Professor
Microbiology Department
PhD Rutgers University Microbiology 1962
Aquatic microbiology
50%

JAMES P. WIGHTMAN
Professor
Chemistry Department
PhD Lehigh University Physical Chemistry 1960
Surface chemistry
50%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental	Master's	2	0	2	0	2	0	4	1	6	1	ENROLLMENT
Sciences	Doctoral	2	0	2	C	4	1	5	1	8	0	
Sanitary	Master's	6	0	10	2	15	1	20	0	26	2	
Engineering	Doctoral	8	0	10	1	8	0	10	0	8	0	

		68-69	69-70	70-71	71-72	72-73	
Environmental	Master's	0	1	2	1	5	GRADUATES
Sciences	Doctoral	1	1	1	1	2	
Sanitary	Master's	8	10	12	14	18	
Engineering	Doctoral	3	4	3	3	0	

Environmental	Master's	0	NON-US NATIONALS
Sciences	Doctoral	1	
Sanitary	Master's	1	
Engineering	Doctoral	2	

	Envir. Sciences		Sanitary Engr.		
	Master's	Doctoral	Master's	Doctoral	
EPA traineeship	3	0	15	0	SUPPORT
Other traineeship	1	0	4	0	
EPA doctoral fellowship	0	1	0	0	
Research assistantship	2	3	2	4	
Teaching assistantship	0	3	0	4	
Industrial fellowship	0	0	1	0	
Government employer	0	1	3	0	
Self-supported	0	0	1	0	
Consulting	20	-	40	25	EMPLOYMENT (%)
R & D	20	15	5	25	
Industry	20	15	10	20	
Federal government	20	30	10	10	
Other government	-	-	30	-	
Academic	-	40	-	20	
Further study	20	-	5	-	

Facilities

In addition to normal laboratory facilities on the Blacksburg campus, the program makes considerable use of several off-campus installations especially the Occoquan Watershed Monitoring Laboratory in Manassas, Virginia. Other field studies are currently being conducted at Smith Mountain Lake and Claytor Lake in western Virginia.

University of Washington

Seattle, Washington

Department of Civil Engineering
College of Engineering

Environmental Engineering

Dr. Vernon B. Hammer, Professor and Head
Water and Air Resources Division
Department of Civil Engineering
University of Washington
Seattle, WA 98195

June 1973

The broad field of instruction and research is divided into five technical areas: water resources, air resources, environmental science, sanitary engineering design, and solid wastes. While the program is designed to provide training in depth in each of these sub-areas, it is also designed to promote interdisciplinary associations so that the approach to the complex problems in today's society may be done on a team basis. Training is provided not only for engineers with various academic backgrounds but also for biologists, chemists, physicists, oceanographers, and atmospheric scientists. A close association is maintained with other related departments including the Institute for Environmental Studies.

Admission Requirements

(a) 3.0/4 normally required for newly graduated students; professional record carries more weight for those applicants with professional experience.

(b) GRE is not required.

(c) Provisional admission is not possible.

(d) Foreign students must score a minimum of 500 on TOEFL.

(e) Prospective students having an engineering, physical science, or biological science degree from an accredited institution are considered for acceptance.

(f) At least three quarter credits are required outside the department for the Master's and at least nine hours outside as a minor for the doctorate.

(g) Two letters of recommendation for Master's students, three letters of recommendation for doctoral students, and a statement on degree and study objectives are required for admission.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MSCE	40Q	Optional	-	-	12
MSE	40Q	Optional	-	-	12
MS	40Q	Optional	-	-	12
PhD	75Q	Yes	2	1 yr.	36

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 342	Fluid Mechanics	Staff	4Q	S'73	-
CE 345	Hydraulic Engineering	Staff	4Q	S'73	-
CE 350	Environmental Engineering	Seabloom	4Q	S'73	-
CE 434	Ecological Effects of Wastewater	Welch	4Q	New'72	-
CE 435	Physiological Effects of Water Pollutants	Welch	3Q	New'72	-
CE 441	Intermediate Fluid Mechanics	Richey	3Q	A'72	-
CE 442	Intro. to Hydraulics in Water Res.	Nece	3Q	S'73	-
CE 444	Coastal Engineering I	Richey	3Q	W'73	-
CE 445	Hydraulic Machinery	Chenoweth	3Q	W'73	-
CE 447	Physical Hydrology	Burges	3Q	A'72	-
CE 448	Open-Channel Engineering	Strausser	3Q	S'73	-
CE 450	Man & Pollution of His Environment	Christman *et al.*	3/5Q	S'73	-
CE 451	Environmental Engineering Design	Bogan	3Q	W'73	-
CE 452	Systems Engineering Fundamentals	Mar	3Q	S'73	-
CE 453	Water & Wastewater Treatment	Bogan	3Q	W'73	-
CE 454	Sanitary Engr. Design Studies	Bogan	3Q	S'73	-
CE 456	The Chemistry of Natural Water Sys.	Christman Spyridakis	3Q	S'73	-

CE 457	Water Quality Analysis	Spyridakis	3Q	W'73	-
CE 458	The Chemistry of Air Pollution	Charlson	3Q	A'72	-
CE 461	Air Resources Engineering I	Rossano	3Q	S'73	-
CE 466	Air Pollution Control	Pilat	4Q	W'73	-
CE 467	Air Pollution Source Test. & Equip. Evaluation	Pilat	3Q	S'73	-
CE 470	Solid Waste Disposal	Seabloom	3Q	A'72	-
CE 485	Sampling Techniques for Water Quality	Welch	3Q	S'73	-
CE 487	Industrial Waste Management	David Mar	3Q	W'73	-
CE 498B	Intro. to Groundwater Flow	Staff	3Q	W'73	
CE 499A	Special Projects: Water & Air Res.	Staff	1-5Q	S'73	-
CE 520A	Seminar	Sylvester	1-6Q	S'73	-
CE 525	Seminar--Atmo. Prob. Assoc. with Air Pollution	Badgley Charlson	2Q	W'73	-
CE 528	Accoustics of Envir. Noise	Chalupnik	4Q	A'72	-
CE 541	Hydrodynamics in Water Quality	Nece	3Q	A'73	-
CE 542	Hydrodynamics I	Nece	3Q	W'73	
CE 543	Hydrodynamics II	Nece	3Q	S'73	-
CE 544	Coastal Hydraulics	Richey	3Q	S'73	-
CE 547	Advanced Hydrology	Burges	3Q	W'73	
CE 549	Experimental Hydrodynamics	Nece	3Q	W'73	-
CE 550	Biological Waste Treatment	Carlson	3Q	New'72	-
CE 551	Sanitary Engr. Unit Operations	Bogan	3Q	W'73	-
CE 552	Design of Water & Waste Treatment Processes	Bogan Charlson	3Q	S'73	-
CE 553	Topics in Ecol. Effects of Wastewater	Welch	3Q	W'73	
CE 554	Adv. Process Chem. for San. Engr.	Christman	3Q	S'73	-
CE 555	Topics in Computer Simulation of Envir. Engr. Systems	Bogan	3Q	A'72	-
CE 556	Industrial Waste Treatment	Carlson	3Q	S'73	-
CE 557	Water Resources System Mgt.	Mar	3Q	A'72	-
CE 558	Water Quality Management	Mar	3Q	W'73	-
CE 559	Water Resources System Management	Mar, Burges	3Q	New'72	-
CE 560	Topics in Environmental Health	Rossano	3Q	W'73	-
CE 562	Air Resources Engineering II	Rossano	3Q	W'73	-
CE 563	Air Resources Management	Rossano	3Q	S'73	-
CE 564	Aerosol Science & Technology I	Charlson	3Q	W'73	-
CE 565	Aerosol Science & Technology II	Charlson	3Q	S'73	-
CE 566	Design of Gaseous Air Pollution Control Equipment	Pilat	5-3Q	A'72	-
CE 567	Design of Particulate Air Pollution Control Equipment	Pilat	5-3Q	W'73	-
CE 571	Solid Waste Management	Mar	3Q	W'73	-
CE 572	Current Topics in Solid Wastes Mgt.	Carlson Hammer	3Q	New'72	-
CE 599A	Special Topics--Water & Air Resources	Staff	2-5Q	S'73	-
CE 599C	Special Topics in Hydrology	Burges	3Q	S'73	-
CE 599D	Water Quality Problems in Estuaries	Mar, Burges Nece, Richey	3Q	New'72	-
CE 600	Research	Staff	-	S'73	-
CE 700	Thesis	Staff	-	S'73	-
CE 800	Dissertation	Staff	-	S'73	-
AtmosSci 528	Applied Meterology & Bioclimatology	-	-	-	-
AtmosSci 535	The Physics of Clouds	-	-	-	-
AtmosSci 462	Sea-Air Transfer Processes	-	-	-	-
BusAdmin 510	Integrative Administration	-	-	-	-
Botany 446	Algology	-	-	-	-
Botany 473	Limnology	-	-	-	-
Chem 418/419	Radiochemistry	-	-	-	-
Econ 435	Natural Resource Utilization & Public Policy	-	-	-	-
EnvHlth 450	Measurement & Control of Air Poll.	-	-	-	-
EnvHlth 453	Industrial Hygiene & Safety	-	-	-	-
EnvHlth 457	Noise & the Environment	-	-	-	-
EnvHlth 568	Occupational Health & Safety Program	-	-	-	-
EnvHlth 577	Control of the Industrial Envir.	-	-	-	-
Epid&Int 420	Principles of Epidemiology	-	-	-	-

Hlth 410	Principles of Communicable Disease Control & Biostatistics	-	-	-	-
Fish 535	Metabolic Effects of Chem. Pollutants	-	-	-	-
Fish 530	Biological Probl. in Water Pollution	-	-	-	-
Fish 531	Seminar in Water Pollution Problems	-	-	-	-
Fish 460	Water Mgt. & Pollution Studies	-	-	-	-
FoodSci 490	Space Biol.: Sealed Life-Support Sys.	-	-	-	-
Forestry 407	Wood Chemistry	-	-	-	-
Forestry 455	Water Shed Management	-	-	-	-
Forestry 476	Pulp & Paper Technology	-	-	-	-
Forestry 514	Forest Influences	-	-	-	-
Geog 370	Conservation of Natural Resources	-	-	-	-
Geog 444	Geography of Water Resources	-	-	-	-
Law 574	Water, Public Land, & the Environment	-	-	-	-
Law 623	Natural Resources Seminar	-	-	-	-
MechEngr 425	Air Conditioning	-	-	-	-
NucEngr 486	Nuclear Power Plants	-	-	-	-
Ocean 401	General Physical Oceanography I	-	-	-	-
Ocean 402	General Physical Oceanography II	-	-	-	-
Ocean 403	General Biological Oceanography	-	-	-	-
Ocean 419	Ocean Tides & Waves	-	-	-	-
Ocean 452	Physical Sedimentology	-	-	-	-
Ocean 462	Applications of Oceanography	-	-	-	-
PolSci 580	Seminar in Metropolitan & Urban Planning Problems	-	-	-	-
Radiology 501	Biological Effects of Ion. Radiation	-	-	-	-
Radiology 510	Special Topics in Radiation Biology	-	-	-	-
Radiology 550	Field Practice in Radiol. Health	-	-	-	-
UrbPl 480	The Urban Planning Process	-	-	-	-
Zoology 572	Topics in Ecology	-	-	-	-
QuantSci 382	Statistical Inference in Applied Res.	-	-	-	-
QuantSci 486	Experimental Design	-	-	-	-

Faculty

WILL BERNARD BETCHART
Research Assistant Professor of Civil Engineering
1973

MS University of Colorado - 1967

Water resource, quality management

100%

"Feasibility of Evaluation of Benefits from Improved Great Lakes Water Quality," Special Report No. 2, University of Illinois Water Resources Center, May 1968 (et al.)

RICHARD H. BOGAN
Professor of Civil Engineering
1954

ScD Massachusetts Institute of Technology - 1954

Theory and design of water and wastewater treatment processes and urban utility systems, water supply and waste management systems

100%

"Preliminary Studies of the Use of Radiolysis in the Treatment of Closed Cycle Wastes--A Final Report," to the Bioastronautics Department of the Boeing Company, Seattle, 1964

"Theoretical Evaluation of Filter Modelling Experiments," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, SA2, pp. 455-465, April 1970 (with C. R. Ott)

"Theoretical Analysis of Activated Sludge Dynamics," Journal Sanitary Engineering Division, American Society of Civil Engineers, 97, SA1, pp. 1-17, February 1971 (with C. R. Ott)

Diplomate, AAEE
Consultant, The Boeing Company, Seattle, Washington
Consultant, Consulting Engineering Firms
Expert Engineering Witness, Superior Courts throughout Washington State and Supreme Court of British Columbia, Canada

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STEPHEN J. BURGES
Assistant Professor of Civil Engineering
1970

PhD	Stanford University	-	1970

Hydrology (digital computers), systems aspects of planning; management of water resources facilities, nonstructural alternatives in water management

50%

"Use of Autoregressive Runoff Models in Reservoir Studies," Proceedings, IASPS Symposium on Statistical Hydrology, Tucson, Arizona, August-September 1971

"Some Problems with Log-Normal Markov Runoff Models," Journal Hydraulics Division, American Society of Civil Engineers, 98, HY9, September 1972

"Reliability of Estimates of the Exceedence Probability of a Given Flood Magnitude," Proceedings, 2nd International Hydrology Symposium, Fort Collins, Colorado, September 1972

"Hydraulic Behavior of the Lummi Project--Recommendations for Closure of a Dyke in Tidal Waters," 1971

"Establishment of Storage-Yield Analysis Methodologies and Reservoir Operation Models that Employ Stochastic Hydrology Techniques," Bechtel Corporation, San Francisco, 7/71-8/71

DALE A. CARLSON
Chairman and Professor of Civil Engineering
1955

PhD	University of Wisconsin	-	1960

Biological waste treatment, solid wastes management; biological treatment processes, denitrification, phosphate removal

50%

Man and the Pollution of His Environment, Goodyear Publishing Company, April 1973 (et al.)

"Combined Biological-Chemical Phosphorus Removal," Journal Water Pollution Control Federation, 44, pp. 1736-1755, 1972 (with G. R. Minton)

"Temperature Acclimation in Aerobic Bio-oxidation Systems," Journal Water Pollution Control Federation, 45, pp. 10-24, 1973 (with A. Benedict)

Member, AEEP
Consultant, Environmental Associates, Corvallis (1973)
Consultant, US Environmental Protection Agency, Federal Water Pollution Control Administration, US Public Health Service (1968-73)
Consultant, METRO (1969-72)

ROBERT J. CHARLSON
Associate Professor of Civil Engineering
1965

PhD	University of Washington	-	1964

Atmospheric chemistry including aerosol science, air pollutants; physical chemistry of the atmosphere

100%

"A Study of the Relationship of Chemical Composition and Humidity to Light Scattering by Aerosols," Journal Applied Meterology, in press 1972 (with D. S. Covert and N. C. Ahlquist)

"Measurement of the Aerosol Total Scatter--Backscatter Ratio," Applied Optics, in press 1972 (with A. P. Waggoner and N. C. Ahlquist)

Man and the Pollution of His Environment, Goodyear Publishing Company, April 1973 (et al.)

Consultant, US Environmental Protection Agency
Consultant, Meterology Research Inc., Altadena, California

HARRY H. CHENOWETH
Associate Professor of Civil Engineering
1946

MS	University of Washington	-	1957

Engineering hydraulics, water quality and quantity control in fish facilities

25%

Applied Strength of Materials, 2nd ed., McGraw-Hill Book Company, 1967 (with A. Jensen)

"A Device for Stamina Measurement of Fingerling Salmonids," Research Report No. 67, US Government Printing Office (with R. Burrows)

Consultant, US Fish and Wildlife Service (1955-69)
Consultant, Department of Fisheries, State of Washington (1968-69)

VERNON B. HAMMER
Professor of Civil Engineering and
Head, Division of Water and Air Resources
1947

MS	Harvard College	-	1941

Solid waste management, environmental engineering and administration

100%

BRIAN W. MAR
Professor of Civil Engineering
1967

PhD	University of Washington	-	1958

Water resource management, systems analysis approach to related problems, economics of water quality management, application and development of system techniques, development of interdisciplinary environmental programs

100%

"Water-Quality Management and Puget Sound," The Trend in Engineering, October 1972

"A System of Waste Discharge Rights for the Management of Water Quality," Water Resources Research, 7, 5, pp. 1079-1086, October 1971

Man and the Pollution of His Environment, Goodyear Publishing Company, April 1973 (et al.)

Consultant, National Science Foundation
Consultant, National Marine Fisheries Service

RONALD E. NECE
Professor of Civil Engineering
1959

ScD Massachusetts Institute of Technology - 1958

Applied hydrodynamics, hydraulic engineering, laboratory and field studies relating fluid mechanics to problems in hydraulic engineering and water resources

50%

"Boundary Shear Stress in Rivers and Estuaries," Journal Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, 96, WW2, pp. 335-358, May 1970 (with J. D. Smith)

"Register of Selective Withdrawal Works in United States," report of Task Committee on Outlet Works, Committee on Hydraulic Structures, Journal Hydraulics Division, American Society of Civil Engineers, 96, HY9, pp. 1841-1872, September 1970 (editor)

"Flushing Characteristics of Small-Boat Marinas," Chapter 143, Vancouver, Canada, in press July 1972 (with E. P. Richey)

Co-Consultant, Oregon State University project on proposed expansion of Portland International Airport (1972)
Co-Consultant, US Army Engineer District, Seattle, Washington (1972)
Consultant, Consumers Power Company, Jackson, Michigan (1972)

MICHAEL J. PILAT
Associate Professor of Civil Engineering
1967

PhD University of Washington - 1967

Air resources engineering, air and gas cleaning, design of air pollution control equipment

100%

"Source Test Cascade Impactor," Atmospheric Environment, 4, p. 671, November 1970 (with D. S. Ensor and J. C. Bosch)

"Effect of Diffusiophoresis on Particle Collection by Wet Scrubbers," Atmospheric Environment, 4, p. 651, November 1970 (with L. E. Sparks)

"Comparison between the Light Extinction-Aerosol Mass Concentration Relationship of Atmospheric and Air Pollutant Emission Aerosols," Atmospheric Environment, 5, p. 209, May 1971 (with D. S. Ensor)

Consultant, Midwest Research Institute
Consultant, Nevada Power Company and Bechtel Corporation
Lecturer, Manufacturing Chemists Association

EUGENE P. RICHEY
Professor of Civil Engineering
1954

PhD Stanford University - 1955

Hydraulic engineering, fluid mechanics, ocean engineering, application of civil engineering to waterways and coastal engineering

25%

"Wave Attenuation by Porous Walled Breakwater," Journal Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, 96, WW3, August 1970

"Hydro-Ecological Problems of Marinas in Puget Sound," Proceedings, Technical Conference on Estuaries of the Pacific Northwest, 1971

"Flushing Characteristics of Small-Boat Marinas," Proceedings, 13th Conference on Coastal Engineering, American Society of Civil Engineers, 1972 (with R. E. Nece)

Consultant, US Army Corps of Engineers
Consultant, Jansen Construction Company

AUGUST T. ROSSANO, JR.
Professor of Civil Engineering
1963

ScD	Harvard College	-	1954

Air resources management, design of aerometric surveys, multidisciplinary approach to environmental quality management

100%

"Guidelines for Preparation of an Air Pollution Source Inventory," Copenhagen, Denmark, in press 1971 (with T. Rolander)

"The Measurement, Cost and Control of Traffic Dust in Seattle's Duwamish Valley," presented at the Annual Meeting of the Pacific Northwest International Section of Air Pollution Control Association, Eugene, Oregon, November 1972 (et al.)

"An Initial Assessment of the Levels of Carbon Monoxide on the University of Washington Campus," presented at the Annual Meeting of the Pacific Northwest International Section of Air Pollution Control Association, Eugene, Oregon, November 1972 (with P. A. Odabashian)

Diplomate, AAEE
Consultant, World Health Organization (Geneva and Copenhagen)
Consultant, Washington State Department of Highways
Consultant, US Environmental Protection Agency

ROBERT W. SEABLOOM
Associate Professor of Civil Engineering
1954

MS	University of Washington	-	1956

Environmental engineering, solid waste management, water quality, treatment and management, leachate studies

100%

"Bacteriological Effect of Small Boat Wastes on Small Harbors," College of Engineering, University of Washington, July 1969

"Radioactive Contamination of Water," Office of Civil Defense, September 1970 (with R. G. Spicher)

"Rest Area Wastewater Disposal," Washington State Department of Highways, January 1972 (with R. O. Sylvester)

Member, AEEP
Consultant, Environmental Resources Association, Redmond, Washington
Consultant, Richard Carothers Associates, Landscape Architects and Environmental Planners, Seattle
Consultant, City of Seattle

DEMETRIOS E. SPYRIDAKIS
Research Associate Professor of Civil Engineering
1970

PhD University of Wisconsin - 1965

Water quality, water chemistry, soil chemistry, soil-water treatment systems

100%

"Adsorption of Parathione in a Multi-Component Solution," Water Research, 6, pp. 1219-1228, 1972 (with W. C. Wang and G. F. Lee)

"Assessment of the Effectiveness and Effects of Land Disposal Methodologies of Waste Water Management," final report to the Office of the Chief of Engineers, US Army Corps of Engineers, January 1972

"Dynamics of Nutrient Supply and Primary Production in Lake Sammamish," Proceedings, Research on Coniferous Forest Ecosystem--A Symposium, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, pp. 301-315, 1972 (with E. B. Welch)

Consultant, Western Research and Development Ltd., Calgary (1969-72)
Consultant, US Corps of Engineers (1971-72)

ROBERT O. SYLVESTER
Professor of Civil Engineering and
Director of the Institute for Environmental Studies
1947

SM Harvard College - 1941

Water resource and water quality management, environmental engineering; water supply, use, quality, and resource management

100%

"Rest Area Wastewater Disposal," Washington State Highway Commission, January 1972 (with R. W. Seabloom)

"Character and Significance of Highway Runoff--A Preliminary Appraisal," Washington State Highway Commission, December 1972 (with Foppe DeWalle)

"Water Quality Criteria, Recreation and Aesthetics, Eutrophication," National Academy of Sciences-National Academy of Engineering, US Environmental Protection Agency, in press (with E. B. Welch)

Member, AEEP
Diplomate, AAEE
Member, Advisory Panel on Public Inquiry for the Chemical and Petroleum Industries, and Forest Products; British Columbia Department of Lands, Forests and Water Resources (1970-date)
Chairman, Technical Advisory Committee to Cornell, Howland, Hayes and Merryfield/Hill; Water Resources Management Study, RIBCO (1971-72)
Consultant, US Agency for International Development Metropolitan Plan, University of Washington Department of Urban Planning (1971)

ALAN P. WAGGONER
Research Assistant Professor of Civil Engineering
1971

PhD University of Washington - 1971

Atmospheric chemistry including aerosol science, air pollutants; physical chemistry of the atmosphere

100%

"Mie Theory Computations of Lidar and Nephelometric Scattering Parameter for Power-Law Aerosols," Applied Optics, 11, p. 2880, 1972 (with H. Harrison and J. Herbert)

"Rayleigh Scattering Coefficients of Freon-12, Freon-22, and CO_2 Relative to that of Air," Applied Optics, 12, 135, 1973 (et al.)

"Optical Absorption by Atmospheric Aerosols," Applied Optics, in press 1973 (with M. B. Baker and R. J. Charlson)

Consultant, Washington State Highway Department
Consultant, Tektronix, Beaverton, Oregon
Consultant, US Environmental Protection Agency

EUGENE B. WELCH
Associate Professor of Civil Engineering
1968

PhD	University of Washington	-	1967

Fundamentals of ecological systems and effects of wastewater; factors controlling primary productivity in natural waters

100%

"Factors Initiating Phytoplankton Blooms and Resulting Effect on Dissolved Oxygen in Duwamish River Estuary, Seattle, Washinton," US Geological Survey, Water Supply Paper, Environmental Quality Series 1873-A, 1969

"Estuarine Periphytic and Planktonic Algal Growth Related to Hydrographic Factors," Limnology and Oceanography, 17, 5, pp. 721-730, 1972 (et al.)

"Dilution as a Control for Nuisance Algal Blooms," Journal Water Pollution Control Federation, 44, 12, pp. 2245-2265, 1972 (with J. A. Buckley and R. M. Bush)

Consultant, CH2M-Hill Engineering Firm (1972-73)
Consultant, Western Research and Development Ltd., Calgary (1969-72)
Consultant, US Corps of Engineers (1971-72)

Students

	68-69		69-70		70-71		71-72		72-73		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master's	24	-	31	9	61	19	47	19	63	17	ENROLLMENT
Doctoral	29	-	26	2	30	8	25	5	17	6	

	68-69	69-70	70-71	71-72	72-73	
Master's	13	11	22	37	20	GRADUATES
Doctoral	7	2	6	10	5	

Master's	5	NON-US NATIONALS
Doctoral	6	

	Master's	Doctoral	
Teaching assistantship	-	4	SUPPORT
Research assistantship	12	6	
Trainee stipends	30	4	
Fellowships/scholarships	1	2	
Government employer	8	3	
Industrial employer	5	-	
Self-supporting	17	4	
Other University support	4	1	

EMPLOYMENT
(%)

	Master's	Doctoral
Academic	5	42
Further study	10	-
Military	4	-
Outside environmental area	2	-
Unknown	11	-
Other government	20	11
Consulting	18	11
R & D	8	21
Industry	6	5
Federal government	16	11

Facilities

Machine and carpentry shop services are available. Equipment includes apparatus and instrumentati necessary for the physical, chemical, and biological analyses of fluids (air and water) and solid wastes. Major fixed facilities include three wave channels and a horizontal flume. Three separate water supply sources allow flexibility of operation over a wide range of flow requirements, and a detached building, together with additional outside space, allow handling of large hydraulic model studies. Equipment for field sampling of air and water is used regularly. Space is provided for bench size and pilot plant research. A gas test chamber and a specially designed clean room for aerosol research are available.

Washington State University

Pullman, Washington

Department of Civil and Environmental Engineering
College of Engineering

Environmental Engineering
Civil Engineering
Environmental Science

Dr. S. K. Bhagat, Professor and Head
Environmental Engineering
Washington State University
Pullman, WA 99163
(509) 335-3175

May 1974

The environmental engineering MS program essentially is process engineering oriented. Three course work options are available for these degrees: water and wastewater engineering, radiological health, and air quality engineering. The water and wastewater engineering program may emphasize either analysis and design of water and wastewater treatment systems or analysis and resolution of water-oriented environmental problems. The radiological health program emphasizes evaluation and resolution of problems arising from the need for human interface with radioactive materials. The air quality program emphasizes monitoring, evaluation, and abatement of air quality problems. The PhD degree in engineering-science is available for all of the above engineering programs. Areas of particular emphasis for the PhD degree include water and wastewater treatment process design, evaluation, and modeling of aquatic biological systems, and radiological engineering.

The environmental science MS degree is offered for nonengineering students desiring career applications in areas of environmental protection and pollution control. Course work options available under environmental engineering department guidance include specialization in water quality, radiological health, air quality, and applied water chemistry. Considerable flexibility in course work requirements to meet individual interests is available through intercollege cooperation.

Washington State University is a major land-grant institution with a broad spectrum of academic resources available to match the interests and needs of individual students. Academic areas of particular importance to environmental science and engineering degree programs include the biological science departments, chemical engineering department, computer science department, and computing center, the nuclear radiation center, and the hydraulics and hydrology programs within the Civil Engineering Department. In addition, Washington State University and the University of Idaho, located just ten miles apart, have developed a program of cooperative courses in civil engineering in which one institution exclusively offers a particular course for use by graduate students of both. This program provides a wider variety of graduate courses than otherwise would be possible at either university. This arrangement permits graduate students at Washington State University to take cooperative courses at the University of Idaho on the same basis that they take resident courses with no additional fees charged.

Admission Requirements

(a) 3.0/4 GPA overall or for last two years of undergraduate study or for total of 12 hours or more of recognized graduate study.

(b) GRE is not normally required.

(c) Students with records less than specified in (a) above may be admitted on provisional status on special departmental recommendation and/or high scores on the GRE.

(d) For foreign students, a minimum TOEFL score of 500 is required.

(e) A BS degree in civil or chemical engineering is recommended for the engineering MS programs although any engineering BS is acceptable. A Bachelor's degree from a recognized four-year institution is the only requirement for entrance to the environmental science programs although a degree in the biological, chemical, physical sciences, mathematics, or resource management is strongly recommended.

(f) Make-up courses will depend upon specific undergraduate background and may include fundamental mathematics and chemistry as well as basic engineering subjects such as fluid mechanics, hydrology, sanitary engineering, and engineering economics.

(g) Applicants requesting financial support must have three letters of recommendation submitted from former professors or employers.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil/Envir. Engr.	30S	Optional[a]	No	2S	8-16
MS--Envir. Science	30S	Optional[a]	No	2S	8-16
PhD--Engineering Science	45S	Yes	No	2 yr.	36[b]

[a] Nonthesis option requires 2-4S directed study and preparation of a report therefrom.

[b] Beyond BS.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 415	Environmental Measurements	Hindin	-	F'73	18
CE 451	Open Channel Flow	Higgins	-	F'73	8
CE 453	Water Resources Engineering	Orsborn	-	S'73	3
CE 470	Fundamentals of Air Pollution	Rasmussen	-	F'73	17
CE 474	Applied Meteorology	Robinson	-	S'74	16
CE 540	Instrumental Analysis for Water Pollution Control	Hindin	-	S'74	7
CE 541	Envir. Engr. Unit Operations I	Ongerth	-	F'73	9
CE 542	Envir. Engr. Unit Operations II	Ongerth	-	S'74	9
CE 543	Environmental Health	Funk	-	S'69	8
CE 544	Wastewater Treatment System	Ongerth	-	S'73	6
CE 545	Industrial Waste Problems	Bhagat	-	S'73	12

CE 546	Water Quality Management	Bhagat	-	F'73	8
CE 547	Radiological Health	Bhagat	-	S'74	8
CE 548	Envir. Health Engr. Practice	Johnstone	-	Su'73	5
CE 549	Radiation Protection	Bhagat	-	S'68	4
CE 551	Turbulent Flow & Diffusion	Mih	-	S'74	11
CE 553	River Engineering	Orsborn	-	S'72	8
CE 561	Water Resources Systems	Warnick	-	S'74	2
CE 571	Air Pollution Meteorology	Robinson	-	S'73	10
CE 572	Air Pollution Measurement Techniques	Adams	-	S'73	6
CE 573	Air Pollution Abate. & Admin.	Adams	-	S'73	12
CE 580	Seminar	Funk	-	F'73	8
CE 581	Sanitary Engineering Analysis	Ongerth	-	S'74	5
CE 583	Engr. Aspects of Aquatic Chemistry	Hindin	-	F'73	5
CE 584	Engr. Aspects of Aquatic Biology	Funk Johnstone	-	S'73	13
CE 585	Chemistry Applied to Treatment Sys.	Hindin	-	New	-
CE 586	Applied Stream Sanitation	Hindin	-	S'73	7
CE 588	Radiological Wastes	Bhagat	-	S'68	8

Courses required of all environmental engineering students majoring in the water pollution field include: CE 415, 541, 542, 545, 546, 583, and 584.

Faculty

S. K. BHAGAT
Professor and Head of Environmental Engineering
Department of Civil and Environmental Engineering
1965

BSc	Punjab University	Chemistry	1954
BS	University of Texas-Austin	Civil Engineering	1961
MS	University of Texas-Austin	Sanitary Engineering	1962
PhD	University of Texas-Austin	Environmental Engineering	1966

Water quality management, environmental assessment, industrial wastes, radiological health

100% (40% teaching, 30% research, 30% administration)

"Correlated Studies of Vancouver Lake-Water Quality Prediction," US Environmental Protection Agency Publication No. EPA-R2-72-111, November 1972 (with W. H. Funk and D. L. Johnstone)

"Biological Treatment of Vegetable Processing Wastes," Proceedings, 28th Purdue Industrial Waste Conference, 1973 (with G. E. Gray and D. E. Proctor)

"Nitrosylruthenium-Nitro Complexes in an Aqueous Environment," Journal Water Pollution Control Federation, 39, 3, pp. 334-345, March 1967 (with E. F. Gloyna)

"Treatment of Dairy Manure Wastes by Lagooning," Journal Water Pollution Control Federation, 41, 5, pp. 785-795, May 1969 (with D. E. Proctor)

"Trace Element Analysis of Environmental Samples by Neutron Activation Method," Journal Water Pollution Control Federation, 43, 12, pp. 2414-2423, December 1971 (et al.)

"Prediction of Impacts on Surface and Ground Water Quality of an Impoundment of the Columbia River at Rock Island, Washington," PUD Chelan County of Washington, 8/73-7/75, principal investigator

"Treatability of Vegetable Processing Wastewaters," The Cedergreen Frozen Foods, Inc., 6/72-5/73, principal investigator

"Study of Silver Lake Eutrophication--Current Problems and Possible Solutions," The State of Washington, Department of Ecology, 4/74-3/75, principal investigator

Previous full-time professional experience: 9 1/2 yrs. (8 yrs. academic and 1 1/2 yrs. research)

Member, Pacific Northwest Pollution Control Association; Chairman, Research Committee (1974)

Member, Advisory Committee on Shoreline Management, Washington Department of Ecology (1973-date)
Member, Washington Board of Certification for Water Works Operators (1969-date)
Consultant, US Civil Service Commission on Regional Training Programs in the area of environmental engineering, environmental assessment, and environmental impacts

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WILLIAM H. FUNK
Associate Professor and Associate Environmental Scientist
Department of Civil and Environmental Engineering
1966

BS	University of Utah	Biology	1955
MS	University of Utah	Zoology and Botany	1963
PhD	University of Utah	Limnology/Sanitary Biology	1966

Limnology; aquatic biology; eutrophication; transport, cycling, and effects of nutrients and heavy metals in aquatic ecosystems

100% (30% teaching, 70% research)

"Phytoplankton Productivity in a Wyoming Cooling Water Reservoir," in Reservoir Fisheries and Limnology (G. Hall, ed.), American Fisheries Society Publication No. 8, 1971

"Bioassays to Determine Algal Growth Potential of Micronutrients," Washington Water Research Center Report No. WRC-A-033-Wash., July 1971 (with R. Condit and W. Craney)

"Trace Element Measurement in the Aquatic Environment," Process of Eutrophication Biostimulation Workshop, Berkeley, California, June 1969 (with S. K. Bhagat and R. Filby)

"Dissolved Air Flotation for Harvesting Unicellular Algae," Water and Sewage Works, 115, 8, pp. 343-347, August 1968 (with W. Sweeny)

"Biological Impact of Combined Metallic and Organic Pollution of the Coeur d'Alene River--Lake Spokane River System, Lake Drainage System," Completion Report, Office of Water Resources Research, July 1973 (with R. Filby and F. Rabe)

"An Integrated Study on the Impact of Metallic Trace Element Pollution in the Coeur d'Alene--Spokane River Lake Drainage System," Office of Water Resources Research, 4/73-7/74, principal investigator

"Investigation to Determine Extent and Nature of Non-Point Source Enrichment and Hydrology of Several Recreational Lakes of Eastern Washington," Washington State Department of Ecology, 7/1/74-12/31/75, principal investigator

"Study of the Benthic Organisms of the Lower Granite Pool Area," US Army Corps of Engineers, 7/1/73-6/30/74, principal investigator

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ERVIN H. HINDIN
Professor and Environmental Scientist
Department of Civil and Environmental Engineering
1963

BS	University of Wisconsin	Chemistry	1951
MS	University of Wisconsin	Sanitary (Water) Chemistry	1956

Water chemistry, sanitary engineering process chemistry, trace organics in water

100% (50% teaching, 50% research)

"Organic Compounds Removed by Reverse Osmosis," Water and Sewage Works, 116, pp. 466-470, 1969

"Transport of Organic Insecticides to the Aquatic Environment," Advances in Water Pollution Research, Proceedings of 5th International Conference on Water Pollution Research, III, 19/1-16, 1971

"Bioconcentration of Arsenic by Activated Sludge Biomass," Water and Sewage Works, 119, pp. 95-97, 1972

"Occurrence of Pesticides in the Aquatic Environment," US Environmental Protection Agency, 1968-70, principal investigator

"Study of Water Quality: Catherine Creek Reservoir," US Army Corps of Engineers, 1970-71, principal investigator

"Detection and Significance of Strong Metal Chelating Agents in Water," Washington State University, Research and Arts Committee, 1972-73, principal investigator

Previous full-time professional experience: 12 yrs. (6 yrs. government and 6 yrs. research)

Advisor to Editor of Standard Methods for Examination of Water and Wastewater
Consultant, US Public Health Service, Community Pesticide Study Program (1965-66)
Member, Water Pollution Control Federation
Member, American Chemical Society

D. L. JOHNSTONE
Assistant Professor and Assistant Environmental Scientist
Department of Civil and Environmental Engineering
1969

BA	Eastern Washington State College	Biology	1964
MS	Washington State University	Bacteriology and Public Health	1966
PhD	Washington State University	Bacteriology	1969

Microbiology of environmental engineering systems, survival of intestinal bacteria under environmental stress

100% (20% teaching, 80% research)

"Migration of Pollutants in Glacial Outwash Environmental Health," Water Resources Research, 7, pp. 713-720, 1971

"Incidence of Enterococci in Feces of Common Wild Birds," Journal Environmental Health, 30, pp. 539-544, 1968

"Migration of Pollutants in Glacial Outwash Environment II," Water Resources Research, 7, pp. 204-208, 1971

"Survival of Intestinal Bacteria in Oligotrophic Waters," Office of Water Resources Research, 1971-73, principal investigator

"Comparative Water Quality in Constructed Swim Embayments and Main Channel Waters--Bacteriological, Chemical, and Physical Parameters," US Army Corps of Engineers, 1971-73, principal investigator

"Rock Island Water Quality Study--Preimpoundment," Chelan County Public Utilities District, 1973-75, co-investigator

Member, Pacific Northwest Pollution Control Association; Chairman, Scientist Committee (1973)
Member, Tri-State Committee on Industrial Bacteriological Problems--Definition and Solutions

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JERRY E. ONGERTH
Assistant Professor and Assistant Research Engineer
Department of Civil and Environmental Engineering
1973

BS	University of California-Berkeley	Mechanical Engineering	1965
MS	University of Michigan	Civil Engineering (Sanitary)	1966
PhD	University of Michigan	Civil Engineering (Sanitary)	1973

Water and wastewater treatment process design, modeling of biological treatment and aquatic systems, solid wastes disposal

100% (50% teaching, 50% research)

"Empirical Analysis of Commercial Solid Wastes Generation," Journal Sanitary Engineering Division, American Society of Civil Engineers, 97, SA6, pp. 843-850, December 1971 (with T. V. Degeare)

"State of the Art of Sludge Dewatering: Mechanical Equipment and Chemical Dewatering Aids," Study Report to Nishihara Environmental Sanitary Research Corporation Ltd., Tokyo, Japan, February 1969 (with T. Asano)

"Study of Current Water Quality and Potential for Restoration, Capitol Lake, Washington," State of Washington Department of General Administration, 4/74-10/75, principal investigator

"Mathematical and Experimental Investigation of Inorganic Nutrient Limited Algal Growth Models," Washington State University Reserach and Arts Committee, 9/74-8/76, principal investigator

"Wastewater Treatment: Optimization of Biological Activity in Carbon Adsorption Systems," State of Washington, 7/74-6/75, principal investigator

Registered professional engineer: Michigan and Washington

Previous full-time professional experience: 5 1/2 yrs. (2 yrs. academic, 2 1/2 yrs. government, and 1 yr. consulting)

Member, Pacific Northwest Pollution Control Association; Member, Special Awards Committee; Member, Student Activities Committee
Member, Water Pollution Control Federation
Member, American Society of Civil Engineers
Member, American Chemical Society

Students

	69-70		70-71		71-72		72-73		73-74		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master's and Doctoral	9	0	13	0	16	0	24	0	23	1	ENROLLMENT
Master's and Doctoral	6		6		5		15		17		GRADUATES
Master's and Doctoral	0		NON-US NATIONALS								

	Master's and Doctoral	
EPA traineeship	5	SUPPORT
Research assistantship	13	
Teaching assistantship	1	
Government employer	1	
Self-supported	4	

Consulting	32	EMPLOYMENT (%)
R & D	8	
Industry	8	
Federal government	20	
Other government	12	
Further study	12	
Military	8	

Facilities

Washington State University has one of the best facilities in the Nation to conduct research in the areas of water and wastewater treatment systems, water quality and limnology of shallow and deep bodies of water, and the impact of trace metals, micronutrients, and pesticides on the aquatic ecosystems. Technicon autoanalyzers, total carbon analyzers, ATP analyzers, atomic absorption spectrometer, infrared, UV, Micro Tek gas chromatographers, and three water crafts equipped with bottom sediment coring devices and other limnological instrumentation are available.

Nuclear Radiation Center has a pool-type 1,000 kilowatt TRIGA fueled reactor, a 2 Mev Van de Graaff accelerator, a 12,000 curie cobalt-60 source, and associated advanced nuclear radiation detection equipment. This facility provides a high flux of neutron, high resolution photon energy detection and the computerized handling of data which is so essential in the simultaneous measurement of 20 or more trace elements in a sample.

The facilities of the University Electron Microscope Center are available for determination of the character of organic and inorganic suspended impurities as well as viable and nonviable organisms.

Wayne State University

Detroit, Michigan

College of Engineering
Department of Civil Engineering

Sanitary Engineering

1868

Dr. Henry A. Dirasian, Professor
Civil Engineering Department
Wayne State University
Detroit, MI 48202
(313) 577-3854

May 1973

The program in environmental engineering at Wayne State University is oriented predominantly toward water quality engineering although options are available in the area of solid waste management and water chemistry. The degrees offered are the MS and PhD in civil engineering.

The University is located in the heart of one of the most industrialized urban areas in the country and hence is dedicated to the further advancement of individuals who are already working in the field. Consequently, a full night-time program is available for working students. The program is complemented by strong support areas in biology and chemistry. Air pollution courses are offerd by the Department of Chemical Engineering located in the same physical plant while a complete Master's degree program is offered in the University's Department of Occupational Health in the College of Medicine. Excellent cooperation exists between all the colleges and departments. Although the University enrollment is greater than 35,000, the enrollment in the College of Engineering is approximately 1,500 with about two-thirds undergraduate and one-third graduate students providing for desirable small-sized classes. Graduate tuition is approximately $800 for the academic year while fees are negligible.

The location of the University, by its very nature, provides students with an unmatched opportunity to couple laboratory and field studies. The extremely large number of industrial plants in the metropolitan complex allows practically unlimited study of industrial wastewaters.

Admission Requirements

(a) 2.6/4 GPA for admission to Master's program.

(b) GRE is not required.

(c) Probationary admission is permitted with a GPA of 2.26/4 on strong recommendation. The student must maintain a 3.0 over his first 12 quarter credit hours.

(d) No language examinations required of foreign students.

(e) Any engineering graduate from an accredited institution is acceptable. Students holding an undergraduate degree in biology or chemistry may also be admitted with prerequisites.

(f) Prerequisites are individually determined. Generally, students take two undergraduate courses in engineering related to the area of interest.

(h) Admission to the PhD program requires a GPA of 3.0/4.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MS--Civil Engr.	45Q	Optional	No	No	12

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 0421	Water Resources	Ordon	3Q	A'73	24
CE 0514	Refuse Collection	Tanaka	3Q	W'74	22
CE 0517	Refuse Disposal	Tanaka	3Q	S'74	17
CE 0521	Environmental Engineering	Ordon	3Q	A'73	26
CE 0522	Sanitary Chemistry	Huang	4Q	A'73	16
CE 0525	Sanitary Laboratory	Huang	4Q	W'74	17
CE 0528	Sanitary Design	Ordon	4Q	W'74	12
CE 0602	Civil Engr. Dec. Processes	Tanaka	4Q	A'73	20
CE 0613	Advanced Hydraulics	Ordon	3Q	W'74	13
CE 0710	Water Resource Management	Tanaka	4Q	W'74	10
CE 0720	Unit Operations & Processes I	Ordon	4Q	A'73	17
CE 0721	Unit Operations & Processes II	Ordon	4Q	W'74	9
CE 0722	Industrial Waste Treatment	Dirasian	3Q	S'73	8
CE 0725	Advanced Sanitary Laboratory	Huang	2Q	S'73	4
CE 0726	Stream Sanitation	Huang	4Q	A'73	7
CE 0790	Directed Study	Staff	1-9Q	W'74	2
CE 0796	Research	Staff	1-9Q	W'74	6
CE 0824	Biochem. Aspects of Waste Treatment	Dirasian	3Q	New	-
CE 0827	Physico-Chemical Principles of Water & Waste Treatment	Huang	4Q	W'74	7
CE 0899	Master's Thesis	Staff	1-12Q	W'74	1
Chem 0555	Intro. to Air Pollution	Kummler	-	A'72	-
O&E Hlth 0502	Principles of Industrial Hygiene	Fredrick	-	A'72	-

O&E Hlth 0605	Atmospheric Pollution	Fredrick	-	S'73	-
O&E Hlth 0720	Air Sampling & Analysis	Mooney	-	W'72	-
Biol 0620	Microbiology	Teodoro	-	S'73	-
Chem 0540	Intro. to Thermodynamics	Ebbing	-	A'72	-

Faculty

HENRY A. DIRASIAN
Professor
Civil Engineering Department
1955

BS	Wayne State University	Civil Engineering	1954
MS	Wayne State University	Civil Engineering	1958
PhD	University of Michigan	Sanitary Engineering	1962

Biological processes in wastewater treatment, industrial wastes, advanced wastewater treatment, stream sanitation

100% (60% teaching, 40% research)

"Electrode Potentials--Significance in Biological Systems," Part I--Fundamentals of Measurement, Part II--Experiments in Biological Systems, Part III--Potentials in Sludge Digestion, Water and Sewage Works, 115, Nos. 9, 10, 11, September, October, November 1968

"Filtration of Waste Plant Effluents," Water and Sewage Works, 117, 3, March 1970

"A Study of Meat Packing and Rendering Wastes," Water and Wastes Engineering, 7, 5, May 1970

"Filtration of Waste Plant Effluents," Office of Water Resources Research, 1967, principal investigator

"Electrochemical Treatment of Wastewaters," Wayne State University, 1970-71, principal investigator

Registered professional engineer: Michigan

Previous full-time professional experience: 1 yr. (1/2 yr. municipal and 1/2 yr. industry)

Chairman, Joint Task Group on O-R Potentials, Standard Methods Committee
Member, State Board of Certification of Industrial Waste Treatment Plant Operators, Michigan
Member, Water Quality Committee, Engineering Society of Detroit
Member, Water Pollution Control Federation
Member, American Society of Civil Engineers

CHIN-PAO HUANG
Assistant Professor
Civil Engineering Department
1971

BS	National Taiwan University	Civil Engineering	1965
MS	Harvard University	Environmental & Sanitary Science	1967
PhD	Harvard University	Environmental & Sanitary Science	1971

Chemistry and biology of natural water systems, applied surface and electrochemistry, water quality and water pollution control

100% (60% teaching, 40% research)

"Heterogeneous Metal Ion Buffers," 158th National American Chemical Society Meeting, New York, 1969 (with W. Stumm and R. S. Jenkins)

"Specific Chemical Interaction Affecting the Stability of Dispersed Systems," Croat. Chim. Acta., 42, 1970 (with W. Stumm and R. S. Jenkins)

"Adsorption Characteristics of Calcium Ion on Hydrous γ-Al_2O_3," presented at American Geophysical Union Meeting, San Francisco, 1971 (with W. Stumm)

Member, American Chemical Society
Member, American Society of Limnology and Oceanography
Member, American Association for the Advancement of Science

CHESTER J. ORDON
Professor
Civil Engineering Department
1946

BS	Tufts University	Civil Engineering	1937
MS	Harvard University	Civil Engineering	1938

Biological water quality, hydrology, water resources, water and wastewater treatment

100% (80% teaching, 20% research)

"Manifolds, Rotating and Stationary," Journal Environmental Engineering Division, American Society of Civil Engineers, 1966

"Environmental Priorities," Water and Sewage Works, 1970

"Simple Algorithm for Cost Optimization of a Three Decision Variable System," Water and Sewage Works, 120, 2, February 1973

Registered professional engineer: Michigan

Previous full-time professional experience: 5 yrs. (1 yr. government and 4 yrs. industry)

Diplomate, AAEE
Member, American Society of Civil Engineers
Member, American Society for Engineering Education
Member, Water Pollution Control Federation

MASARU TANAKA
Assistant Professor
Department of Civil Engineering
1970

BS	Kyoto University	Sanitary Engineering	1964
MS	Northwestern University	Civil Engineering	1967
PhD	Northwestern University	Civil Engineering	1970

Solid wastes management, water resources management, systems analysis, environmental health

100% (50% teaching, 50% research)

"Refuse Quantities and Frequency of Service," Journal Sanitary Engineering Division, American Society of Civil Engineers, 94, SA2, pp. 403-420, April 1968 (with J. E. Quon and A. Charnes)

"Simulation Model of Refuse Collection Policies," Journal Sanitary Engineering Division, American Society of Civil Engineers, 95, SA3, pp. 575-592, June 1969 (with J. E. Quon and S. Wersan)

"Recent International Subjects and Trends Concerning Environmental Pollution in USA," Journal Environmental Pollution Control, Japan, 8, 1, pp. 69-74, January 1972

"Use of Irradiation in Plastic Waste Disposal," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SA3, pp. 561-567, June 1972 (with T. Mifune)

"The Distribution of Radiation Exposure within the Plane of a Circular Line Source," The Health Physics Journal, 21, pp. 602-605, October 1971 (with A. L. Miller and H. Cember)

Member, American Society of Civil Engineers
Associate Member, Operations Research Society of America

Students

		69-70		70-71		71-72		72-73		73-74		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental	Master's	6	15	8	20	9	22	6	28	30		ENROLLMENT
Engineering	Doctoral	0	1	0	2	0	4	0	5	4		
Environmental	Master's	5		8		9		8		8		GRADUATES
Engineering	Doctoral	0		0		0		0		0		
Environmental	Master's	8		NON-US NATIONALS								
Engineering	Doctoral	2										

	Master's	Doctoral	
Other traineeships	1	1	SUPPORT
Research assistantships	2	0	
Other University support	1	1	
Government employer	4	0	
Industrial employer	6	1	
Consultant employer	5	2	
Self-supported	9	0	
Consulting	20	0	EMPLOYMENT (%)
R & D	5	0	
Industry	15	0	
Federal government	15	0	
Other government	20	0	
Further study	5	0	
Military	5	0	
Unknown	15	0	

Facilities

The facilities available include approximately 2,000 square feet distributed in the form of an instructional laboratory, a graduate student research laboratory and two faculty research laboratories. The location of the University near the industrial complex of city coupled with sophisticated analytical equipment provides an excellent opportunity for conducting many types of research projects for students.

West Virginia University

Morgantown, West Virginia

Civil Engineering Department
College of Engineering

Environmental Engineering

ECPD Accredited--Civil Engineering

Dr. Emory L. Kemp, Chairman
Department of Civil Engineering
West Virginia University
Morgantown, WV 26506

May 1973

The orientation of the environmental engineering graduate program at West Virginia University is directed toward preparing students to work for private consultants, industry, and governmental regulatory agencies. The student may specialize in air pollution control, solid waste management, or water and wastewater treatment and related areas. The student may also generalize in two or three of the specialty areas. Degrees offered are the MSCE, MSE, and PhD. The MSCE is offered only to students holding a specified BSCE. The MSE is offered to graduates of engineering programs other than civil engineering and to graduates of physical and biological sciences. To qualify for the MSE program, the candidate must complete basic undergraduate courses which serve as the basis for the graduate program in environmental engineering.

The University is a land-grant institution and has strong programs in engineering, science, arts, law, medicine, and commerce. The enrollment is approximately 15,000 with around 2,900 graduate students. West Virginia University is located near the northern border of the state in Morgantown. Morgantown and the surrounding communities have a population of approximately 30,000. Pittsburgh is about 75 miles north and the higher ridges of the Appalachian Mountains are located to the east.

Admission Requirements

(a) 3.0/4 for regular graduate student.

(b) GRE is not required.

(c) Students with GPA of 2.5/4 may be admitted as regular with deficiency and those with GPA less than 2.5/4 as special-provisional graduate student.

(d) Foreign students must score a minimum of 450 on TOEFL.

(e) Any engineering discipline or undergraduate degree in the physical or biological sciences from an accredited institution is acceptable.

(f) Nonengineers must complete with credit differential equations, hydraulics, and undergraduate sanitary engineering.

(g) The Department of Civil Engineering may request letters of recommendation.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MSCE	[a]	Optional	No	None	18
MSE	[a]	Optional	No	None	18
PhD	60S[b]	Yes	Yes	[c]	42

[a] 24S with thesis option; 30S with problem report option (no thesis); and 36S with neither thesis nor problem report.

[b] Not specified.

[c] Two consecutive school terms.

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CE 222	Open Channel Flow	Staff	3S	F'68	11
CE 251	Public Health Engineering	Jenkins	3S	S'73	18
CE 252	Water Resources Engineering	Burchinal	3S	F'72	18
CE 345	Properties of Air Pollutants	Linsky	3S	F'72	20
CE 349	Solid Waste Disposal	Zaltzman	3S	F'72	32
CE 350	Sanitary Chemistry & Biology	Jenkins	3S	F'72	17
CE 356	Principles of Biological Waste Treat.	Sack	3S	F'72	15
CE 359	Basic Radiological Health	Sack	3S	S'72	5
CE 446	Air Pollution Control Engineering	Linsky	3S	F'72	10
CE 447	Air Pollution Control Studies	Linsky	3S	S'73	10
CE 448	Air Pollution Control Programs	Linsky	3S	S'73	8
CE 452	Water Treatment Theory	Jenkins	3S	S'73	10
CE 454	Industrial & Advanced Waste Treatment	Sack	3S	S'73	12
CE 455	Man & Industrial Design of Solid Waste Disposal Operation	Zaltzman	3S	S'73	16

CE 457	Hyd. of Sanitary Engineering Works	Burchinal	3S	S'72	15
CE 458	Design of Sanitary Works	Burchinal	3S	S'73	16
CE 422	Surface & Subsurface Drain	Moulton	3S	S'70	15
CE 484	Groundwater & Seepage	Moulton	3S	F'72	9
CE 490	Advanced Design Prob. (Envir. Plan)	Neumann	3S	F'72	16
IE 213	Engineering Statistics	Staff	3S	S'73	26
IE 214	Adv. Analysis of Engineering Data	Staff	3S	S'73	18
Physics 318	Dynamic Meteorology	Williamson	3S	S'73	8
Soc 204	Complex Organizations	Kolaja	3S	S'73	26
PolSci 226	Prob. of State & Local Governments	Temple	3S	S'73	30
Med 312	Community Health	Morgan	3S	S'73	84
BS AD 216	Personnel Management	Staff	3S	S'73	40
Bact 348	Sanitary Bacteriology	Millar	3S	F'71	15

Specific courses may be required depending on the area of interest within the field of environmental engineering.

Faculty

CHARLES R. JENKINS
Professor
Civil Engineering
1961

BS	Eastern Illinois State College	Chemistry	1952
MS	University of Illinois	Zoology	1959
PhD	Oklahoma State University	Zoology	1964

Stream pollution, water treatment, waste treatment, environmental health

100% (60% teaching, 35% research, 5% administration)

"Ditches Provide Efficient Treatment," Environmental Science and Technology, 3, November 1969 (with J. C. Burchinal)

"Toxicity Bioassay of Oil Refinery Effluents in Oklahoma," Transactions, Seminar Biological Problems in Water Pollution, 1959 (with T. C. Dorris and W. R. Gould)

"Disposal of Sludge from Acid Mine Water Neutralization," Journal Water Pollution Control Federation, 1971 (with Show-Jong Yeh)

"Safety in West Virginia Waste Treatment Systems," Water and Sewage Works, December 1972 (with C. T. Regula)

"Roadside Rest Area Project," Federal Highway Administration, 1972-date, investigator

"Reverse Osmosis for Treatment Acid Mine Drainage," US Environmental Protection Agency, 1972-date, consultant

Previous full-time professional experience: 3 yrs. (academic)

Member, AEEP
Trustee, West Virginia Section of American Water Works Association (1971-date)
President, West Virginia Association of Water Pollution Control Federation (1969)

Member, Publications Committee, Association of Environmental Engineering Professors (1973)

JERRY C. BURCHINAL
Professor
Civil Engineering
1946

BSCE	West Virginia University	Civil (Sanitary) Engineering	1944
MSCE	West Virginia University	Civil Engineering	1950

Water supply and pollution control, hydrology and hydraulics, solid wastes

100% (60% teaching, 30% research, 10% administration)

"Comprehensive Survey of the Monongahela River," Volume I (Inventory, West Virginia Department of Natural Resources), 1973 (with M. Baloch and E. Henry)

"Where Solid Waste Comes From: Where It Goes," Modern Hospital, February 1972 (with L. Wallace and R. Zaltzman)

"Leaching from Simulated Landfills," Journal Water Pollution Control Federation, pp. 371-379, March 1970 (with S. Qasim)

"Leaching of Pollutants from Refuse Beds," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, SA1, pp. 48-58, February 1970 (with S. Qasim)

"Ditches Provide Efficient Treatment," Environmental Science and Technology, 3, November 1969 (with C. R. Jenkins)

"Runoff Studies on Small Watersheds," Water Research Institute funded by US Department of Interior, 1966-date, principal investigator

"Effect of Agricultural Pollutants on Runoff Waters," Water Research Institute funded by US Department of Interior, 1972-date, principal investigator

Registered professional engineer: West Virginia

Previous full-time professional experience: 2 yrs. (government)

National Director, West Virginia Water Pollution Control Association
Member of Consulting Engineering firm of Burchinal, Urquhart and Weekley, Civil and Sanitary Engineering Consultants
Member, Governor's Advisory Council on Comprehensive Health Planning and Chairman, Environmental Health Committee of this Council

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WILLIAM A. SACK
Associate Professor
Civil Engineering
1966

BS	University of Pittsburgh	Civil Engineering	1957
MS	Michigan State University	Soil Mechanics	1960
PhD	Michigan State University	Sanitary Engineering	1964

Advanced and industrial wastewater treatment, biological waste treatment, water resources management

100% (60% teaching, 30% research, 10% administration)

"Cellular Phosphorus Changes under Low Carbon Stress in Escherichia Coli," Journal Water Pollution Control Federation, 45, 1, 1973 (with N. E. Hopson)

"Biological Treatment of Spent Vegetable Tannins Using Fungal and Bacterial Systems," presented at 45th Annual Water Pollution Control Federation Conference, October 1972 (with M. D. Atluru and D. V. Kalyani)

"The Feasibility of Joint Treatment of Acid Mine Drainage and Domestic Sewage," presented at 28th Purdue Industrial Waste Conference, May 1973 (with T. A. Helinski and R. K. Drazba)

"Evaluation of the Bio-Disc Process for Summer Camp Application," Water Pollution Control Research Series, US Environmental Protection Agency, 1973 (with S. Phillips)

"Factors Affecting Wastewater Reclamation and Recycle," Proceedings American Association of Cost Engineers, pp. 7-13, 1970

"Evaluation of the Bio-Disc Process of Wastewater Treatment at a Summer Camp," 5/72-6/73, principal investigator

"Use of Bottom Ash as a Filter Medium," National Ash Association, 9/70-5/71, principal investigator

Previous full-time professional experience: 3 yrs. (2 yrs. industry and 1 yr. government)

Member, AEEP
Program Chairman, West Virginia Water Pollution Control Association (1973)
Member, Visiting Lecturers Committee, Association of Environmental Engineering Professors (1973)
Member, Morgantown Sanitary Board (1972-date)

RAUL ZALTZMAN
Professor
Civil Engineering
1967

BS	Universidad Nacional Autonoma de Mexico	Math and Physics	1954
BS	University of Oklahoma	Civil Engineering	1962
MS	University of Oklahoma	Civil Engineering	1963

Solid waste management

100% (60% teaching, 25% research, 15% administration)

Lixo e Limpieza Publica (textbook for sanitary engineers and public works administrators), Universidade de Sao Paulo--Faculdade de Higiene e Saude Publica, Organizacao Mundial do Saude (WHO) Sao Paulo, Brasil, 1969 (et al.)

"The Sanitary Land Disposal of Solid Wastes," Proceedings, Solid Waste Disposal Symposium, Pittsburgh, March 1971

"Where Solid Waste Comes From: Where It Should Go," Modern Hospital, February 1972 (with J. C. Burchinal and L. P. Wallace)

Manuals on: (1) Sanitary Landfill Practices, (2) Composting, (3) Incineration, (4) Volume Reduction, and (5) Planning of Solid Waste Management Systems, West Virginia University/Pan American Health Organization/World Health Organization, Intensive Short Course and Symposium on Solid Waste Management Practices, Morgantown, West Virginia, July 1972

"Disposal of Wastepaper by Aerobic Digestion with Sewage Sludge," Waste Age Magazine, accepted for publication in December 1972 issue (with A. Tarquin and A. J. Serafim)

"Solid Waste Training Grant," US Environmental Protection Agency, 1967-date, director

"Roadside Rest Area Project," Federal Highway Administration, 1972-date, project director

Registered professional engineer: Oklahoma

Previous full-time professional experience: 4 yrs. (2 yrs. consulting and 2 yrs. academic)

Consultant, Office of Solid Waste Management Programs, US Environmental Protection Agency (1971-date)
Member, American Public Works Association; Member, Subcommittee on Intergovernmental Relations of the Institute for Solid Wastes
Consultant, Pan American Health Organization, World Health Organization (1969-date)

BENJAMIN LINSKY
Professor
Civil Engineering
1963

BSME	Wayne State University	Mechanical Engineering	1947
MSE	University of Michigan	Mechanical Engineering	1948

Air pollution

100% (60% teaching, 30% research, 10% administration)

"Keep the Automobiles, Trucks, and Buses out of Our Air," presented at the Conference on Automobile Pollution, Toronto, Canada, June 1972

"Internal Reflection Spectroscopy Applied to Air Pollution," Atmospheric Environment, May 1969 (with F. M. Noonan)

"Smoke Abatement in Chicago," Maxwell Reprint Company, 1971

"The Use of Color Infrared Photography in the Detection of Non Visible Injury to Vegetation by Ozone," presented at International Clean Air Conference, Melbourne, Australia, May 1972 (with H. Bravo and A. Lowe)

"Residential Customer's Cost of Air Pollution Control in the Electric Utility Industry," US Environmental Protection Agency, 1/72-12/72, director

"Fog Extension due to Air Pollutants," US Environmental Protection Agency, 5/68-date, director

"Noise from Air Pollution Control Equipment Operation," US Environmental Protection Agency, 8/72-date, director

Registered professional engineer: Michigan and California

Previous full-time professional experience: 21 yrs. (16 yrs. government, 2 yrs. industry, and 3 yrs. military)

Diplomate, AAEE
University representative, Institute of Ecology
President, Air Pollution Control Association (1956-57)

LYLE K. MOULTON
Associate Professor
Civil Engineering

PhD	West Virginia University	Soil Mechanics	1968

Stabilization of landfills, groundwater pollution, solid waste disposal
20%

EDWARD S. NEUMANN
Assistant Professor
Civil Engineering

PhD	Northwestern University	Civil Engineering	1969

Environmental planning
25%

Students

		68-69		69-70		70-71		71-72		72-73		
		FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Environmental Engineering	Master's	33	5	25	3	37	4	35	5	50	7	ENROLLMENT
	Doctoral	15	0	15	0	6	2	3	3	4	3	

		68-69	69-70	70-71	71-72	72-73	
Environmental Engineering	Master's	19	15	20	19	17	GRADUATES
	Doctoral	5	5	3	3	2	

Environmental Engineering	Master's	20	NON-US NATIONALS
	Doctoral	5	

	Master's	Doctoral	
EPA traineeship	26	0	
NIH traineeship	2	0	
Research assistantship	4	3	
Teaching assistantship	0	1	
Other University support	0	1	SUPPORT
Industrial fellowship	0	1	
Foundation support	0	1	
Self-supported	26	1	
World Health Organization	2	0	
Consulting	22	25	
R & D	2	-	
Industry	4	-	
Federal government	22	25	
Other government	24	-	
Further study	7	50	

Military	7	-	EMPLOYMENT (%)
Outside environmental area	3	-	
Unknown	9	-	

Facilities

West Virginia University has very well equipped laboratories for investigating environmental engineering problems. The small school atmosphere helps facilitate cooperative projects with other areas of the University such as the School of Medicine, Agricultural Microbiology, Biology Department, Chemistry Department, and Physics Department. Local Federal facilities which offer an opportunity for cooperative studies are the Morgantown Research Center of the US Bureau of Mines and the National Institute for Occupational Safety and Health of the Health, Education and Welfare Department.

The University of Wisconsin

Madison, Wisconsin

Department of Civil and Environmental Engineering
College of Engineering

Civil and Environmental Engineering

ECPD Accredited--Department of Civil and Environmental Engineering

Dr. William C. Boyle
Professor of Civil and Environmental Engineering
3230 Engineering Building
The University of Wisconsin
Madison, WI 53706
(608) 262-1776

December 1973

The program of study in sanitary engineering is oriented to permit specialization in water and wastewater treatment, water pollution control, and solid wastes engineering. Several closely related environmental programs of study within the Department of Civil and Environmental Engineering, such as hydraulic and ocean engineering, water resources engineering, remote sensing of the environment, and water chemistry, provide elective course work, support, and encourage the multidisciplinary approach to the solution of environmental problems.

Emphasis is placed on the engineering application of sanitary engineering process principles for the design and operation of water, wastewater, and solid wastes control structures at the Master's degree level. Extensive specialization in these areas is provided in a research-oriented program at the doctoral level.

The program is intended primarily for students with an academic background in engineering. Special programs of study (without extensive prerequisites) are arranged for students with academic backgrounds in the basic sciences.

The University of Wisconsin is a land-grant and sea-grant college with both undergraduate and graduate programs of study with a total enrollment of 36,000. The Madison campus is located on the shores of Lake Mendota, the largest of four lakes in the Madison area.

Admission Requirements

(a) 2.75/4.

(b) GRE is not required for entrance but is required for scholarship and fellowship evaluation.

(c) Undergrduates with a GPA of 2.6/4 can be admitted on probation and must show promise of satisfactory graduate work 3.0/4 or better.

(d) Foreign students can be admitted with the following language scores:

ELI/Mich.	TOEFL	Status
90-100	580-699	Full-time academic program
85-89	525-580	Full-time--allowance reading
80-84	490-525	3/4 time plus English 3 hrs/week

(e) Individuals with undergraduate degrees in civil, environmental, or other branch of engineering, as well as the sciences, are normally acceptable.

(f) Differential equations, dynamics, and fluid dynamics or hydraulics are required of nonengineers.

(g) Three letters of recommendation are necessary to be considered for financial support.

(h) Letters of reference from former graduate studies advisors are required for PhD program.

Degree Requirements

Degree	Credits	Thesis	Language	Residence	Time (mo.)
MSCEE	[a]	Optional[b]	No	None	12
MSE	[a]	Optional[b]	No	None	12
PhD	54S	Yes[c]	1[d]	1 yr.	-

[a] With nonthesis option, 30S and with thesis option, 24S.

[b] The student may elect to enroll in 3-5S of advanced independent study and present a report.

[c] 12-20S for thesis.

[d] Language requirement may be satisfied by demonstration or advanced competency on the ETS language examination for a single foreign language, satisfactory completion of four semesters of a language, or by completion of 12 credits of course work in the humanities or social studies area (at least on pass/fail basis) as approved by major professor (at least 6 of these credits must be taken while student is enrolled in the Graduate School).

Course Work

Designation	Title	Instructor	Credits	Last Pres.	Enrollment
CEE 315	Hydrology	Huff	3S	S'73	44
CEE 320	Sanitary Engineering	Boyle	3S	F'73	91
CEE 321	Environmental Pollution Control	Berthouex Boyle	3S	F'73	19
CEE 325	Water Distr. & Collection Systems	Polkowski	3S	S'73	21

CEE 326	Water & Wastewater Treat. Plant Des.	Polkowski	3S	F'73	23
CEE 327	Solid Wastes Engineering I	Ham	3S	F'73	32
CEE 411	Open Channel Hydraulics	Monkmeyer	3S	S'73	9
CEE 413	Hydraulic Machinery	Lenz	3S	F'72	8
CEE 415	Water Resources Engineering	Lenz	3S	S'73	16
CEE 416	Optimiz. & Simul. of Water Res. Sys.	Joeres	3S	S'73	10
CEE 423	Air Poll.--Effects. Measur., Control	Myers	3S	F'73	16
CEE 424	Water Analysis	Peterson	3S	F'73	21
CEE 511	Ocean Dynamics	Green	2S	F'73	7
CEE 512	Air-Sea Interaction	Green	2S	F'73	6
CEE 514	Coastal Engineering	Green	2S	S'73	9
CEE 515	Ocean Environment	Green	1-4S	S'73	10
CEE 518	Ocean Engineering Seminar	Green	1S	F'73	6
CEE 521	Industrial Waste Treatment	Berthouex	2S	S'73	29
CEE 552	Remote Sensing of the Environment	Kiefer	3S	F'73	44
CEE 580	Water Chemistry	Armstrong	3S	F'73	29
CEE 581	Water Analysis-Intermediate	Armstrong	3S	F'73	19
CEE 582	Marine Chemistry	Veith	2S	S'72	15
CEE 611	Hydrodynamics	Hoopes	3S	F'72	4
CEE 621	Solid Wastes Engineering II	Ham	3S	S'73	9
CEE 624	Cost Engr. for Water Poll. Control	Berthouex	2-3S	F'73	7
CEE 629	Special Topics in Sanitary Engr.	Staff	1-2S	S'73	6
CEE 714	Flow through Porous Media	Monkmeyer	3S	S'72	9
CEE 720	San. Engr. Process Principles & Design I	Ham Polkowski	3S	F'73	21
CEE 721	San. Engr. Process Principles & Design II	Boyle Polkowski	3S	S'73	15
CEE 722	San. Engr. Process Principles & Design III	Berthouex Boyle Polkowski	2S	Su'73	12
CEE 780	Advanced Water Chemistry	Lee	3S	S'73	9
CEE 781	Adv. Techniques of Water Analysis I	Armstrong	3S	S'73	18
CEE 783	Organic Water Chemistry	Armstrong	2S	S'72	10
CEE 811	Theory of Water Waves	Monkmeyer	3S	S'73	6
CEE 916	Seminar in River Basin Planning	Joeres	3S	S'73	2
CEE 919	Hydr. Engr. & Fluid Mech. Seminar	Hoopes	1S	S'73	11
CEE 929	Sanitary Engineering Seminar	Polkowski	1S	F'73	27
CEE 988	Water Chemistry Seminar	Armstrong	1S	F'73	16
CEE 990	Thesis	Staff	-	F'73	54
CEE 999	Advanced Independent Study	Staff	-	F'73	49
Bact 303	General Microbiology	Wilson	4S	S'73	175
Geology 463	Hydrogeology	Stephenson	3-4S	S'73	43
Statistics 424	Statistical Exp. Design	Hunter	3S	F'73	26

CEE 424, 720, 721, 722, 929, 990, or 999; Statistics 424 and bacteriology or biology are required of all students for MSCEE and MSE.

Faculty

PAUL MAC BERTHOUEX
Associate Professor
Department of Civil and Environmental Engineering
1971

BS	State University of Iowa	Civil Engineering	1963
MS	State University of Iowa	Sanitary Engineering	1964
PhD	University of Wisconsin	Sanitary Engr./Chemical Engr.	1970

Advanced wastewater treatment, process design and operation, systems and analyses, applied statistics, and system modeling

100% (60% teaching, 40% research)

"Optimum Sewage Treatment Plant Design under Uncertainty," Journal Water Pollution Control Federation, 42, 9, September 1970 (with L. B. Polkowski)

"Monte Carlo Simulation of Industrial Waste Discharges," Journal Sanitary Engineering Division, American Society of Civil Engineering, 95, October 1969 (with L. C. Brown)

"Probability Theory as an Aid to Research Planning," Journal American Water Works Association, 61, December 1969

"Evaluating Economy of Scale," Journal Water Pollution Control Federation, 44, November 1972

"Realistic Oxygen Transfer Efficiency of Mechanical Surface Aerators," Proceedings, Purdue Industrial Waste Conference, May 1973 (with W. C. Boyle and T. Rooney)

"Advanced Treatment of Municipal Wastewater," Madison Metropolitan Sewerage District, 10/71-12/74, co-investigator

"Reverse Osmosis Treatment of Activated Sludge Secondary Effluents," REXNORD Inc., Milwaukee, 1/73-1/74, principal investigator

"Modeling and Control of Wastewater Treatment Plants," National Science Foundation (RANN), 1972-73, co-investigator

Previous full-time professional experience: 4 yrs. (2 yrs. academic and 2 yrs. research)

Member, Advisory Committee for Engineering Statistics
Consultant, Tennessee Valley Authority, Water Quality Branch

WILLIAM C. BOYLE
Professor
Department of Civil and Environmental Engineering
1963

CE	University of Cincinnati	Civil Engineering	1959
MS	University of Cincinnati	Sanitary Engineering	1960
PhD	California Institute of Technology	Environmental Health Engineering	1963

Biological treatment processes, fate of pathogens in environment, unsewered wastewater treatment and disposal, leachate treatment from sanitary landfills, remote sensing

100% (50% teaching, 40% research, 10% administration)

"Mass Transfer Limitations in Substrate Removal," Journal Sanitary Engineering Division, American Society of Civil Engineers, 96, SA2, p. 525, 1970 (with C. R. Baillod)

"Identification of Filamentous Microorganisms in Activated Sludge," Journal Water Pollution Control Federation, 43, p. 604, 1971 (with C. J. Farquher)

"Rapid Quantitative Method for Salmonella Detection in Polluted Water," Applied Microbiology, 21, p. 662, 1971 (with C. M. Cheng and J. M. Goepfert)

"Enhanced Phosphorus Removal in Trickling Filters," Journal Sanitary Engineering Division, American Society of Civil Engineers, 98, SA3, p. 547, 1972 (with Harold Jebens)

"Reflectance and Transmittance Characteristics of Several Selected Blue Green Unialgae," Water Research, 6, p. 1433, 1972

"Advanced Treatment of Sewage Effluents," Wisconsin Department of Natural Resources, 12/71-12/74, co-investigator

"Small-Scale Waste Disposal," State of Wisconsin, Upper Great Lakes Regional Planning Commission, US Environmental Protection Agency, 6/71-6/76, co-investigator

"Leachate Generation and Landfill Disposal of Foundry Sands," American Foundryman's Society, 6/73-7/76, co-investigator

Registered professional engineer: Ohio and Wisconsin

Diplomate, AAEE
Member, Water Pollution Control Federation; Member, Research Committee; Member, Planning Committee
Member, American Foundryman's Society; Member, Wastewater Committee
Member, American Society of Civil Engineers; Member, Professional Activities Committee

ROBERT K. HAM
Associate Professor
Department of Civil and Environmental Engineering
1967

BS	The University of Minnesota	Chemical Engineering	1960
MS	University of Washington	Chemical Engineering	1965
PhD	University of Washington	Sanitary Engineering	1967

Chemical aspects of water treatment, coagulation and flocculation processes, water chemistry, solid waste disposal, leachate treatment, recycling, refuse processing

100% (60% teaching, 40% research)

"Large-Elevation Landfills for Refuse Disposal," Public Works, January 1970

"Velocity Gradient Paths in Coagulation," Journal American Water Works Association, 63, 7, p. 439, 1971 (with R. TeKippe)

"Refuse Milling for Landfill Disposal," Public Works, December 1971, January 1972, February 1972 (with W. Porter and J. Reinhart)

"Refuse Milling," US Environmental Protection Agency and City of Madison, 1967-75, co-principal investigator

"Treatability of Leachate from Sanitary Landfills," US Environmental Protection Agency, 1970-73, co-principal investigator

"Recycling of Solid Wastes," National Science Foundation, 1972-74, investigator

Previous full-time professional experience: 3 yrs. (industry)

Member, State of Wisconsin Governor's Task Force on Recycling
Commissioner, Madison Metropolitan Sewerage District
Member, National Sanitary Landfill Committee, NSWMA
Advisor on Landfill Methods, National Center for Resource Recovery

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LAWRENCE B. POLKOWSKI
Professor
Department of Civil and Environmental Engineering
1954

BS	University of Illinois	Civil Engineering	1950
MS	The University of Wisconsin	Sanitary Engineering	1951
PhD	The University of Wisconsin	Sanitary Engineering	1958

Water and wastewater treatment plant design, water and wastewater filtration, sludge thickening, farm waste disposal, industrial waste treatment

100% (50% teaching, 40% research, 10% administration)

"Optimum Sewage Treatment Plant Design under Uncertainty," Journal Water Pollution Control Federation, September 1970 (with P. M. Berthouex)

"Filtration of Activated Sludge Secondary Effluents through Sand and Anthracite-Sand Beds," Technical Report OWRR A-006-Wis., June 1969 (with Y. Misaka)

"Thickening of Compressible Sludges," Proceedings, Purdue Industrial Waste Conference, May 1973 (with J. A. Cole and J. A. Hoopes)

"Correlating Odor Intensity Index and Odorous Components in Stored Dairy Manure," American Society of Agricultural Engineers Meeting, December 1972 (with C. L. Barth)

"Evaluation of Methods for Estimating Biochemical Oxygen Demand Parameters," Journal Water Pollution Control Federation, October 1972 (with D. Marske)

"Advanced Treatment of Secondary Treatment Effluents by Filtration," Madison Metropolitan Sewerage District, 1972-74, co-investigator

"Landfill Practice for Mixtures of Sewage Treatment Plant Sludge and Milled Refuse," Department of Natural Resources, State of Wisconsin, City of Madison, Madison Metropolitan Sewerage District, 1973-74, co-investigator

"Thickening and Dewatering Properties of Lime Softening and Alum Clarification Sludges," Department of Natural Resources, State of Wisconsin, principal investigator

Registered professional engineer: Wisconsin

Previous full-time professional experience: 3 yrs. (academic)

Member, Water Pollution Control Federation; Chairman, Subcommittee "Regulation of Sewer Use"
Vice President, Madison Metropolitan Sewerage Commission
Research Consultant, US Environmental Protection Agency, Demonstration Grants for Industrial Waste Treatment; Tanning Industry; Dairy Industry; and combined municipal treatment for Pulp and Paper Industry

DAVID E. ARMSTRONG
Associate Professor
PhD The University of Wisconsin Soil Science 1966
Water chemistry
80%

ELIZABETH MCCOY
Professor, Bacteriology
PhD The University of Wisconsin Bacteriology -
Applied microbiology, fermentations, biological treatment, pollution indicators
60%

ERHART F. JOERES
Assistant Professor
PhD The Johns Hopkins University Geography & Environmental Engr. 1969
Water resources, systems analysis
80%

JAMES L. CLAPP
Professor
PhD The University of Wisconsin Civil Engineering 1964
Remote sensing of the environment
80%

DALE D. HUFF
Associate Professor
PhD Stanford University Hydrology 1968
Hydrology and hydrologic modeling, environmental radioactivity
50%

WILLIAM G. HUNTER
Professor, Statistics
PhD The University of Wisconsin Statistics 1963
Model building, experimental design, process operations

JOHN O. HOOPES
Professor
PhD Massachusetts Institute of Technology Civil Engineering 1965
Hydraulics, dispersion, thermal problems
50%

JAMES R. VILLEMONTE
Professor
PhD The University of Wisconsin Civil Engineering 1949
Hydraulics, water resources engineering
30%

DALE F. RUDD
Professor, Chemical Engineering
PhD University of Minnesota Chemical Engineering 1960
Systems analysis, process engineering
20%

EDWIN W. LIGHTFOOT
Professor, Chemical Engineering
PhD Cornell University Chemical Engineering 1951
Transport phenomena, bioengineering
20%

S. M. WU
Professor, Mechanical Engineering
PhD - - -
Statistics, dynamic system control
10%

GEORGE E. P. BOX
Professor, Statistics
PhD London University Mathematical Statistics 1952
Model building, experimental design, EVOP, stochastic modeling, control of dynamic stochastic systems
10%

Students

	68-69		69-70		70-71		71-72		72-73		
	FT	PT	FT	PT	FT	PT	FT	PT	FT	PT	
Master's	6	7	11	7	21	11	25	7	27	8	ENROLLMENT
Doctoral	8	2	9	0	6	0	5	1	5	1	
Master's	-		3		5		13		7		GRADUATES
Doctoral	-		5		3		0		2		

NON-US NATIONALS

Master's	3
Doctoral	3

SUPPORT

	Master's	Doctoral
EPA traineeship	16	0
Other traineeship	0	1
Research assistantship	8	0
Teaching assistantship	1	1
Other University support	1	2
Foundation support	0	1
Government employer	6	0
Self-supported	3	1

EMPLOYMENT (%)

	Master's & Doctoral
Consulting	38
R & D	2
Industry	5
Federal government	3
Other government	27
Academic	17
Further study	3
Military	5

Facilities

The available facilities directly related to the sanitary engineering program include: 13,000 square feet of research laboratories, instructional laboratories, and graduate student office laboratories; 1200 square feet for pilot plant and model studies located in the Lakeshore Laboratory; and 700 square feet of research facilities for the purpose of solid wastes studies and investigations in the Engineering Research Building; pilot plants for advanced wastewater treatment by biological, physical, and chemical methods with associated analytical laboratory at Madison Nine Springs Municipal Wastewater Treatment Plant. Boats and docking facilities are available for lakes and streams studies related to eutrophication, water pollution, and waste assimilation studies. Other facilities available within the department, but not included in the area housed indicated above, are remote sensing laboratories and equipment, hydraulic and fluid mechanics laboratories, water chemistry and limnological laboratories, water resources center libraries, and several shops for fabrication of research equipment and pilot units.

Engineering Computer Laboratory, Engineering Library, and Engineering Research Building support the research activities, as do numerous other specialized research laboratories and centers such as a Biotron, University Computer Center, Instrumentation Systems Center, Environmental Awareness Center, Institute for Environmental Studies, Water Resources Center, Marine Studies Center, Nuclear Reactor Laboratory, Space Science and Engineering Center, and Statistical Consulting Laboratory.